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ELECTRICITY AFLOAT.

A Boat Propelled by Electricity.

M. TROUVE SUCCESSFULLY APPLIES ELECTRICITY TO NAVIGATION—NO ENGINE, NO BOILERS, NO SMOKE, NO DANGER—THE DANGEROUS STEAM-LAUNCH—ITS SUCCESSOR, THE ELECTRIC-LAUNCH—HOW THE ELECTRICITY IS APPLIED—FUTURE POSSIBILITIES.

The steam launch, as everybody knows, is a boat, usually from fifteen to forty feet in length, with either an open or covered cabin in the after part, and is designed for pleasure parties or for use as a ferry-boat between unimportant points. At one time, when a novelty, steam launches were very popular, and were to be seen in large numbers in pleasant weather skimming about among the larger craft that navigate our rivers and other water-courses. Latterly, however, since people have experienced the discomforts of these little steamers, the demand for them has greatly decreased, and their idle hulls may be seen hauled up on the shores of waters upon which they were wont to dance so merrily. The reasons for this are not far to seek. To sit in the engine-room of a stationary engine ashore is far from pleasant by reason of the odors of lard and other oils, but to have these odors blown in your face and the dust and cinders of a smoke-stack showered upon you, as those experience who journey in steam-launches, is more than unpleasant—it is unbearable.

Go out in a steam-launch upon the river or the bay when the freshest winds, the balmiest airs of summer blow, and you have with you, ever present, the odor of lard oil. Nor may the cabin be placed in another position in a small steam-launch. On the large steam-yachts recently built, the cabins are placed forward of the engine, the latter being set well aft. But in the steam-launch this is impossible. There is no room forward for a cabin, and the safety of such craft would be threatened by the steady weight of the engine aft and the shifting and changing load forward.

Happily for those who would navigate tidal waters without being at the mercy of inconstant winds, electricity has come to their aid, and we herewith present to the readers of the ELECTRICAL REVIEW a faithful illustration of a boat which combines all the virtues of the steam-launch while at the same time possessing none of its discomforts.

This boat, called the "Eureka," is the design of that skillful and ingenious electrician, M. Trouvé, being propelled by the electrical power generated by a six-cell Trouvé battery. By means of a winch, the elements of this battery may be more or less immersed in or completely withdrawn from the exciting liquid, consisting of one part of bichromate of potash, three and one-half parts of sulphuric acid and eight of water.

The current is led through the tiller ropes, made for the purpose, of twisted wires, covered with silk and cotton, and encased in an india-rubber tube, to what is called the *gouvernail moteur propulseur*, or combined rudder and propeller.

The electrical motion, designed by M. Trouvé, while in many ways similar to the Siemens coil, has been made by modification to possess more efficiency than the latter when thus applied to marine architecture. It is placed in the rudder-head while the propeller itself revolves in a slot in the rudder itself, motion being communicated by an endless chain. So great is the action of the rudder intensified by this arrangement that, unlike its prototype propelled by steam, this boat can be made to turn almost on its own center. Thus a complication of machinery required in order to permit of a boat's forward movement being reversed, is rendered unnecessary. The tiller ropes are provided with contacts to enable the steersman to instantly stop the movement of the boat or start or back her. By taking off the rudder, which can be carried under the arm, the owner of such a boat can always make sure, while anchored in unfrequented waters, that no one will run off with her.

So fast will this electrical boat travel through the water that, at a recent trial, a four-oared gig or racing boat going at full speed was easily overhauled and passed by her.

Now, there are said to be over two hundred electric boats, built upon the model of the Eureka, navigating French and English waters, and contracts are being made for the construction of many more.

We look forward with agreeable anticipation to the construction of one of these craft for our own waters, in the full conviction that, when its many advantages are thoroughly comprehended, the building of a fleet of them will follow.

The electrical boat glides smoothly and quickly over the water. There is no smoke and no disagreeable odors Instead of the cumbrous engine and huge coal bunkers, to fill which the craft must be covered with coal dust, there are accommodations for passengers, the batteries taking up but little room in comparison.

Again, as is well known, the engine of a steam-launch is, unless watched with great care, liable to breaks and even more serious accidents. The pipes and gauges are so small that they are easily clogged up, especially when salt water is used in the boilers, and it is not an unusual thing for the water-gauge facing the cabin, to register "full water" in the boiler when in reality there is hardly any at all, and many an excursion party has been surprised to see the engineer suddenly open his doors and draw his fires as if life itself depended upon his getting them out without a second's delay, which in many instances has been known to be the case.

No such dangers attach to the use of the electrical boat. Of course, where a continuous journey is contemplated, the electrical boat could not at the present time be used, for the reasons that there are, as yet, no electrical stations established where a new supply of electricity could be had when the storage battery aboard had been exhausted. Until the establishment of these, however, the boat may be run until half the stored power of its batteries is drawn and the return trip made with the balance.

The time is not far distant, however, when electrical storage stations will be found on the banks of all populous water-courses and the owner of the electrical boat can obtain a new supply of electrical power without difficulty, and at a cost too, which, instead of proving as in the case of the steam-launch, by far the largest item in his expense account, comparatively insignificant.

The American District Telegraph Co. has filed papers in two suits against the Mutual District Messenger Co. (Limited) and Mutual District Telegraph Company for infringement of patents of Wm. H. Sawyer, of Providence, R. I., and Rogers and Crane, of Boston.

On the Composite Character of the Induction Spark.

BY COUNT DU MONCEL.

(Translated for the ELECTRICAL REVIEW *from La Lumière Electrique.)*

We have already spoken several times in this journal (*La Lumière Electrique*) on these two lines of discharge, chiefly in connection with the subject of magnetic reactions on the spark, but the subject was treated more fully in our number of June 15th, 1879, in treating of the various forms of the electric arc. We, nevertheless, deem it to be useful to return to the subject at this time, for the reason that in the preceding article it was discussed very briefly, and in all the works treating specially of static electricity, M. Mascart's among others, the matter has been dismissed in a few lines.

I had already treated of this subject in the latter editions of my notice on the Ruhmkorff apparatus, but in my pamphlet on the non-homogeneity of the induction spark, I have treated it with all the fullness that the subject allows. I will now give a summing-up of that work.

It is noteworthy that all the effects in question were much better developed and more easy to observe in the earlier Ruhmkorff machines than in those which are now made. The modern makers seem to have aimed at the single end of lengthening the spark, and to reach this result they have sacrificed quantity to tension by using very fine wires in the secondary coils. At first this was not done; the wires were thicker, and the bobbins longer, and if the sparks obtained were only 2 centimeters * long, they were well maintained, enveloped by a dense aureola, and productive of calorific effects much more intense, for the same battery, than those of the machines made nowadays. We shall, therefore, speak of the effects produced by these earlier machines in this article.

If we attentively examine the Ruhmkorff coil induction spark, we first notice that it is not simple, and that it is composed of several luminous darts of extreme whiteness, surrounded by a species of sheath or luminous envelope of a dull greenish red, which seems to surround it like a luminous atmosphere, and which is sensitive to the movements of the surrounding air. It is this envelope which has been called the *aureola*. It is produced by a layer of air heated by the spark, and this layer, in proportion to the conductivity thus acquired, serves as a vehicle for the transmission of the greatest portion of the charge. The spark, then, is composed of two distinct portions—one represented by the flashes of light of the direct discharge, which constitute the spark, properly so called; and the other represented by the aureola, which is only a discharge transported by an aeriform conductor, and which reddens under

* 2 centimeters = .78 inches, or about ¾ inches.—TRANS.

the influence of that conduction, in proportion to the insufficiency of its conducting power. The experiments that I undertook on the subject of these currents demonstrated that they did not have the same characteristics—that one was produced by electricity of high tension, having the characteristics of that produced by the glass plate machines, while the other acted as a quantity current, analogous in its effects to that of a battery. We shall study, farther on, the means which I have employed to recognize these different properties, but one can easily comprehend that, judging from the characteristics themselves, I concluded that the aureola was only the result of the spark, properly so called, as manifested in the sparks or flashes of fire of the direct discharge. M. Lissajous irrefutably demonstrated this fact later, by rapidly turning a Foucault mirror in front of the spark, which showed that the spark advanced like a dart before the aureola, which seemed to follow in its path. This conclusion was afterward confirmed by M. Foucault, who, having adapted the poles of a Bunsen cell to an excitor whose points were separated by an interval of one-quarter of a millimeter*, could procure the passage of a current across that solution of continuity by passing a discharge of static electricity across it. Since that time this method has been employed by several physicists, notably by M. Gassiot, to excite discharges which had not sufficient tension to cross the solution of continuity of themselves, and it was found even that the simple influence of a stick of resin, previously rubbed, sufficed to provoke the discharge. It will be seen later, on the other hand, that the simple presence of a conducting body placed above the place of the solution of continuity exercises an influence of the same character.

If we examine the consequences which must result from the very different origins of the two portions of the induction spark, we arrive at the conclusion that by arranging the experiments so as to facilitate the conductivity of the gaseous medium conducting the quantity discharged and constituting the aureola, we augment it at the expense of the tension discharges; and on the contrary we augment the latter at the expense of the aureola by proceeding in a contrary manner. Consequently if we pass the spark through a glass phial in which we successively produce a vacuum, we see the sparks of fire forming the direct discharge diminish successively in proportion as the aureola increases, and they soon disappear altogether leaving the aureola to amplify and to take a beautiful red color, which seems to start from the positive pole and pass to the negative, widening a portion of the latter.

With a suitable vacuum, the aureola will soon be seen to stop at a certain distance from the negative excitor whose surface will be covered by a rather thick layer of blue light, and the latter viewed from the other side of the phial seems to be composed of three layers of different shades of blue. Under these conditions all the discharge is converted into a quantity current.

But a vacuum is not necessary to obtain effects of this character, and I demonstrated in 1859 that if we pass the induction spark between two plates of glass separated by a very small space, similar in width to the thickness of the very thin metallic plates employed as excitors of the discharge, one can develop the aureola under the same conditions as before described, and obtain on the two electrodes the red and blue colored lights, of which we have already spoken, together with the dark space that separates them from the negative pole, the only noticeable difference being that the darts of light of the direct discharge run through the various luminous effluvia, producing colored illuminations, to which I particularly wish to draw attention. This portion of my investigations on this subject is the least known, and has not yet been treated in this journal nor in my notice of the Ruhmkorff apparatus.

To see this phenomenon in all its beauty, recourse must be had to the microscope and the spark allowed no more than two millimeters length at the most. The electrodes are composed of thin plates of various metals which are introduced longitudinally, one in front of the other between two glass plates, and these being held at the two ends by little clasps of bronze, it is easy to attach the two wires of the circuit to the two metallic electrodes which project beyond the glass. The apparatus being thus disposed, we place it on the stage of the microscope, taking care to have the space between the two metallic points in the middle of the field of vision, and then pass the current through it. A magnifying power of 80 diameters will suffice very well for analyzing the phenomenon represented in the cut. (See Fig. .)

The positive electrode is pointed and the negative electrode slightly rounded; and it is on the latter that the blue light of which we have spoken is spread out, and which is displayed in front in the form of irregular blotches, which, however, regularly circumscribe the borders of the electrode.

The aureola, properly so called, of a beautiful roseate hue, seems to break out from a brilliant lip of pale rose color which terminates the positive electrode, then takes on a bell shape and stops at some distance from the negative electrode, moulding itself in some degree to the shape of the latter; then through this luminous sheet appear the dazzling white lines of light of the direct discharge, which change from one electrode to the other, producing on the latter scintillating luminous points whose color varies with the kind of metal used for the electrodes. They are generally, however, of a greenish yellow with copper, of an emerald green with silver and cadmium, a beautiful blue with zinc and bismuth, a beautiful yellow with lead, gold, or tin, and of a fiery red with platinum and iron. It is these luminous points which determine the general color which the spark presents to the eye, for the color of the two other sources of light remain about the same in free air, no matter what metal is used for the electrodes nor what may be the appearance of the aureola to the naked eye. But in different gaseous media the result is different, and we can then determinate approximately what is the nature of the gas through which the discharge passes, by the color of the aureola. The flashes of light of the direct discharge do not appear clearly and sharply arrested as would be expected by studying the spark in free air.

If we blow on the spark thus produced with a bellows, the two polar lights are displaced and projected from the sides, but they still present the obscure or non-luminous space of which we have spoken, and which still moulds itself on the shape of the negative electrode.

Then the luminous jets are separated and sharply limited, ending on a black background. Under the conditions of the preceding experiment, there are produced nearly the same effects as in the experiment with the spark in the electric egg, for the air included between the two plates of glass around the discharge is dilated to such a degree that it presents a small resistance to the electric transmission, and the space being limited by the plates of glass, places the experiment in very different conditions to those in which the air is free; it is probably to this circumstance that we should attribute the change of the aspect of the aureola, the separation of the two lights and their different colors. Perhaps the glass itself exercises a certain effect; it is certain that we may regard the spark produced between the two plates of glass as a representation in miniature of what takes place in the vacuum, with the addition of the jets of light of the direct discharge which do not exist in the latter case.

In order that the experiment should be successful, it is necessary to take several precautions: First, the electrodes must be flat, cut in points, blunted at the two edges, and firmly compressed between the two plates of glass; in the second place, it is necessary that the tension of the current be not too great, so that the jets of the direct discharge shall not acquire too great importance; lastly, it is essential that the solution of continuity shall not be too wide (about 1 or 2 millimeters for one Bunsen cell), so that the aureola may be well developed, and that the red light shall be plainly apparent under the microscope. Nevertheless, this distance may be made to vary with the intensity of the current, and with a few trials one can succeed in producing the phenomenon with distances varying from 2 to 4 millimeters, the current varying from 1 to 2 Bunsen cells. If the distance between the electrodes is at its maximum, considering the tension of the current, the red light is entirely absent between the positive and negative poles, but these poles are still colored, one red and the other blue, the same as when the experiment is complete, and the yellow filaments only remain in the middle of the solution of continuity. No matter how great the solution of continuity may be, the metallic transportation and fusion will soon hide the phenomenon, and it will then be necessary to change the places of the electrodes in order to continue the experiment. Although the transfer of metallic particles produced by the current may be contrary to the description of the phenomenon above given, it produces under the microscope a most curious and beautiful effect, especially on the negative electrode. The red and blue lights which pass behind the deposits formed successively on the plates of glass, illuminate them with the most vivid colors, and form in the microscopic field figures analogous to those which are shown in crystallization produced under the solar microscope. If the electrodes are plates of gold, the deposits formed on the glass are in the shape of connected, smooth, beautiful and tenacious gilding.

As I have stated, the colors of the polar lights do not generally vary with the metals which are used as electrodes; nevertheless, if these are very fusible, very soft, or reduced to an extreme thinness, or if the induced current is very intense, the volatilization of the particles of these metals, under the calorific influence of the spark, produces a slight change in the appearances described, particularly of the negative electrode. Then the light of the luminous scintillating points, from which the darts of fire of the direct discharge shoot out, predominate sometimes on the negative electrode and sometimes on the positive. The result is that, on the one hand, the obscure band separating the two polar lights disappears, and is displaced by a dull glow of the same color as the scintillating points; and on the other hand, the light of the negative electrode can scarcely be seen on the corresponding electrode. But with plates of a certain thickness, and with certain precautions, we can always produce the luminous effects which we have described, and which we may consider as the general type of the induction spark.

The scintillations produced by the hard metals are of a different nature, in proportion to the calorific energy of the spark. Generally they are of a greenish yellow, but when they attain an incandescent temperature they become of a marked reddish yellow color. Besides, it is necessary to distinguish in these scintillations the central point of the species of aureola which surrounds this point; this is what indicates their color, because the central point is so dazzling that it appears nearly white. With metals that are easily fusible, these scintillations change their color less; thus they give origin to the glimmers of which we have spoken, and which we will hereafter describe more in detail in stating the luminous effects produced by different metals

Copper.—Positive, light red; negative, light blue, rather long; obscure space well marked; scintillations, greenish; darts of light of the direct discharge, greenish yellow.

Gold.—Positive, light red; negative, light violet blue; obscure space well marked; scintillations, golden yellow; darts of the direct discharge, yellowish, and inclined to green.

Iron and Steel.—Positive, light red; negative, light, a beautiful blue; obscure band sharply defined; scintillations, yellow, inclining to red; very brilliant at the positive pole; sparks of light, rather greenish. At the end of a few moments, when the plates are very thin, the positive red light is completely effaced by a brilliant yellow glow, which mingles with it so as to form a pronounced fiery red; then the negative light seems to be drowned by this new light, and becomes sown with blotches of red light, which are only aggregations of metallic particles heated to a red color. When the plates are thick, the scintillations are less noticeable and faintly greenish.

Silver.—Positive, light red; negative, light violet, furrowed with obscure circular bands arising from the oxydization of the metallic plates; dark space sharply defined; scintillations of a magnificent emerald green, and forming, especially in the dark space, one or wo luminous nuclei, well developed and of a beautiful effect; jets of light greenish yellow.

Aluminum.—Positive, light rose-colored; only some traces of the blue light of the negative pole on the borders of the negative electrode; scintillations of a rosy white, sometimes surrounded by a large aureola of green; obscure space occupied by a rosy white glimmer, accompanied on the sides by two green lights, the traces of which can be found even in the vicinity of the positive pole; from time to time small threads of little fiery sparks shoot out from scintillations of golden yellow; jets of light of the direct discharge, yellowish violet.

Cadmium.—Positive, light red, especially near the positive electrode; negative light absent; scintillations of a well-marked light green; obscure space occupied by a rather brilliant glow of light green, sometimes extending to near the negative electrode; lines of light of direct discharge of a dull lilac color.

Lead.—Positive, light rose-colored, often mingled with the lines of light of the direct discharged; negative, light absent, dark space occupied by a beautiful chrom yellow glow forming a sort of border around the negative electrode; scintillations yellow, sparks of fire, violet and zig-zag in form, glow equally yellow and very intense at the positive pole. With thick plates the luminous effect is the same as that produced by hard metals.

Tin.—Same effects as the preceding, the yellow shade tending to reddish.

Bismuth.—Positive, light feeble red, scarcely visible in the middle of the solution of continuity and completely overwhelmed by the scintillations from the positive pole, which furnish a magnificent greenish blue light; negative, light violet.

Zinc.—Positive, light rose colored; some traces of a violet blue; negative, light scintillations blueish and yellowish; obscure space occupied by an equal blue, of which some traces are found on the positive electrode, and which mingle with the positive light; lines of light yellowish. When this metal is used in thick plates and an intensity spark is used, it presents identically the same luminous effects as copper, iron, etc. Since the gaseous medium interposed in a discharge conducts that discharge in a great measure, and is illuminated by it, it is easy to comprehend that the color of this illumination, that is to say, the color of the aureola of the spark ought to partake of the chemi-

* ¼ millimeter = .00984 in., or about 1-1000 of an inch.—TRANS.

cal nature of the gaseous medium itself, and the experiment demonstrated this to be a fact.

Vapors fulfill a part analogous to that of gas. The vapor of water renders the spark of a reddish violet. The vapor of essence of turpentine also causes it to be reddish, but the effect is much less marked than with the vapor of water.

[*To be continued.*]

The most recent items from Moscow in regard to the coronation preparations are that no fewer than 4,000 electric lamps cover the cupola of the great belfry tower and 120 the cross; that new parquet flooring is being laid down in all the grand halls of the Kremlin; that a soldier with a fixed bayonet stands over every group of workmen, and that the hotel prices have already advanced to fabulous heights. Invitations to the ceremony having as yet been issued only to men, some anxiety exists at St. Petersburg among the ladies.

Ball's Unipolar Dynamo Electric Machine.

The Unipolar Dynamo Electric Machine is the name given to the electric generator invented and patented by Mr. Chas. E. Ball, formerly of Philadelphia, but now located in this city, which is quite different from the Pacinotti, Gramme, Brush, Edison, Weston and all other generators now in use.

The following extracts from one of Mr. Ball's patent specifications explain his invention:

"Heretofore, dynamo electric machines have been so constructed that the armature revolved in the field, or within the inductive influence of two or more poles of a magnet or magnets. I have discovered that by employing only one pole of the field magnet, or what amounts to the same thing, arranging the armature to rotate within the inductive influence of only one pole of the field magnet, vastly improved results can be obtained—that is, that greater quantity and increased intensity of current are secured, while at the same time the armature will require much less power to effect its rotation than would be necessary if rotated in the field of two or more poles."

"I have further discovered that by constructing a dynamo electric machine with two armatures, each of which revolves within the inductive influence of only one pole of a magnet, and connecting the rectangular soft iron frame, is converted into two long electro-magnets with two poles, magnet and armature helices in one circuit, the quantity and intensity of current generated will be vastly increased."

One of Mr. Ball's unipolar machines is now on exhibition at No. 41 Kirby street, Hatton Garden, London and has recently been tested by Mr. Robert Sabine and other prominent English electrical experts.

The results of the tests made by Mr. Sabine have been embodied in a report from which the following is taken:

"This machine consists of a long rectangular frame of soft iron, coiled so as to form the field magnets, and which longitudinally supports the axes carrying two bobbins of the Pacinotti type. The main peculiarity of the machine is that each bobbin is rotated in the presence of only one magnetic pole, the opposite side of the bobbin facing a neutral point of the field. Hence the name "Unipolar," by which the inventor designates his dynamo. The effect of this so-called unipolar arrangement, in so far as the field is concerned, appears to be that the only one being presented to each of the rotating bobbins, instead of four shorter and proportionally weaker electro-magnets having four poles as in the ordinary way, by which two opposite poles would be presented to each of the bobbins.

When I tested the system the dynamo was run with six arc lamps, also said to be of Mr. Ball's invention, the dynamo being worked on the "series" system, that is to say, field magnets, armatures, and lamps all joined up in series. The speed of the machine was not so regular as could have been desired, and the Morin dynamometer by which the power given to the dynamo was measured, would have worked steadier had it been driven quicker or with a heavier load. The following are the mean results which I found:—

Current in circuit = c = 15.0 amperes.

Potential difference between terminals = E = 195 volts.

Resistance of dynamo = r = 4.5 ohms.

Speed of dynamo, 1,650 to 1,715 revolutions per minute.

Speed of dynamometer = s = 332 revolutions per minute.

Indicated pull on dynamometer, less pull when circuit open = k = 52 kilos.

From these values—

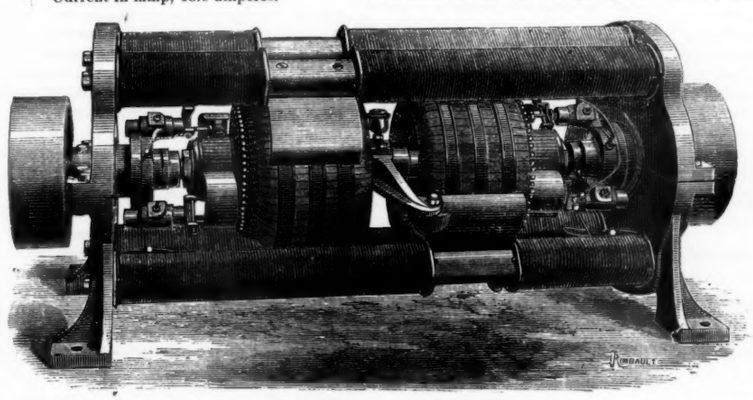
(1) Given to dynamo for electrical work, 5.68-horse power.

(2) Accounted for in outer circuit, 3.92-horse power.

(3) Accounted for in inner circuit, 1.35-horse power.

The proportion accounted for electrically, therefore, 0.92, of which 0.69 was accounted for in the lamps. This would leave only 8 per cent. for the so-called Foucault currents. Photometric measurements were made with one of the lamps, placed apart from the others in a dark recess, the light of the five remaining lamps not being measured. The following mean results were obtained during the observations:

Current in lamp, 13.9 amperes.



BALL'S UNIPOLAR DYNAMO MACHINE.

Potential difference, 40.1 volts.

Accounted for in lamp, 0.75-horse power.

The illuminating effects were as follows:

Position of arc with regard to photometer.	Illuminating power.	
	Observed.	Per I. H. P. accounted for in the lamp.
	Standard candles.	Standard candles.
22 deg. below.	602	802
11 deg. do.	626	835
Horizontal.	887	1.183
11 deg. above.	1,213	1,617
22 deg. do.	1,831	2,441
31 deg. do.	1,859	2,479
35 deg. do.	1,690	2,253

The London *Engineering* states that, according to Mr. Sabine's report, the power accounted in the external circuit of Mr. Ball's machine is about 5 per cent. in excess of the figures given by the committee of the late Electrical Exhibition in Paris for the Gramme five-light, the Siemens five-light, the Burgin three-light and the Weston ten-light machines.

The London *Electrical Review*, in referring to Mr. Ball's invention, says:

"It appears certain that one inductor pole is quite sufficient to magnetize the iron ring of the armature to saturation, and the so-called Foucault currents are apparently diminished. This machine, then, seems to possess all the good points of the Gramme, and something more. There are, perhaps, also mechanical advantages in the manufacture of these machines, which will suggest themselves to engineers, and, indeed, from the tests already made public, it is evident that the Ball machine is second to none of its class, and if it can be conclusively proved, by means of other tests, that the power consumed in the *internal circuit* is less than that in other machines of the Gramme or Pacinotti type, and we have reason to believe this to be so, then Mr. Ball's apparatus is well worthy of the serious attention of those who interest themselves in electric lighting progress."

Our correspondents from London report that the six arc lights employed burned very steady, giving a vivid and brilliant light and everything a natural appearance, and there was but little heat in the machine.

Twelve incandescent lamps of the Edison, Gatehouse and Woodhouse and Rawson form were also tried on a branch circuit, and burned very steadily in connection with the circuit embracing the six arc lamps.

W. H. Preece, Latimer Clark, and a number of other prominent English electricians who have inspected Mr. Ball's machine, pronounce it a very good and ingenious invention.

We called upon Mr. Ball a few days ago, and learned that the machine now in London is one of his first patterns, and was made at an agricultural implement works in Canada, where machines of the said pattern have been in operation for some time past. It has two armatures connected in series, each being on a separate shaft and revolving in opposite directions, and each subjected to the inductive influence of but one pole piece. This arrangement can, however, be modified in various ways; for instance, both the poles may be of the same polarity and the armatures rotate in the same direction on one or two shafts. Instead of connecting the armatures in series for proper electromotive force and quantity, they can be connected in multiple or parallel circuit for greater quantity. The said machine has about 168 pounds of copper wire upon its armatures and field magnets, this being, however, more than is employed in the later forms of machine to produce the same work. Mr. Ball has been engaged during the past four years in making exhaustive experiments with armatures, armature cores, field magnets, arc lights, electric motors, and every conceivable and practical modification of his unipolar discovery.

Judging from the results accomplished by one of his generators of the latest pattern, which is shown in the accompanying illustration, it is quite evident that he has made very important improvements in the dynamo electric generator and arc lamp.

In the said machine two armatures and two commutators are on one shaft and revolve in the same direction, each armature being subjected to the inductive influence of but one pole-piece.

The weight of copper wire on armatures and field magnet bars of the latter-named machine is about..... 280 lbs.
Weight of iron..... 661 "
Copper in two commutators..... 30 "
Weight of composition, bearings, &c..... 26 "
Total weight of machine..... 997 lbs.

Recent experiments have demonstrated that it can produce 23 very steady arc lights of about the same intensity as those produced by the machine now in London, and without developing excessive heat in any part of the machine. Mr. Ball has other improvements in course of construction, and it is his intention to make his electric generators and system of electric lighting as perfect, complete and simple as possible. He is confident that his latest improved generator will produce greater electrical energy and give more light for the copper wire and iron employed and power expended than can be produced by any other generator thus far devised or suggested, and that the heating effect will be reduced to a minimum.

It is quite possible that Mr. Ball's discoveries and inventions will effect a complete revolution or change in the future construction of dynamo-electric generators.

The Brush Storage System.

It is now quite evident that we shall see at an early day another system of incandescent lighting.

The officers of the Brush Incandescent Illuminating Company announce that Mr. Brush is now ready to manufacture storage batteries at the rate of seventy a day, the works in Cleveland, O., being finished. For the last six months, work has been going on upon the new buildings, which are intended solely for the manufacture of batteries, and are supplied with engines of 2,000 horse-power. Mr. Brush says that he has greatly improved his batteries since the exhibition of their power, which was given last autumn, and now has no hesitation in competing with gas or any system of electric lighting

He became convinced years ago that the arc light, while well suited to street illumination, would not do for dwelling houses, or even for many public buildings. The light is too trying to the eyes, and casts too black shadows to be pleasant in doors. The incandescent light is as soft as that of gas and does not affect the atmosphere. For reasons of economy it was decided that any system which would permit of incandescent and arc lighting from the same machines and wires was to be aimed at, and the storage battery was settled upon as the best device for holding the electricity for each house. The great advantage of the storage battery is that no matter how irregular the charging of the battery may be, its emission of electricity is perfectly steady; no matter how a cistern may have been filled, the flow of water from its faucet will be perfectly regular. The great trouble in feeding incandescent lamps directly from a dynamo machine is that the light shows every variation in the running of the engine; every time the belt seam passes over the fly-wheel a tremor in the light shows it; when the engine runs faster or slower, it is perceptible at once. The current used for the arc lights would never do for incandescent lighting, owing to its irregularity; but it is just as good for charging a battery as any other current. The plan of the Brush company is, therefore, to put batteries into every cellar and connect them with the street wires which feed the street lamps.

The company is making four standard sizes of battery—five lights, ten lights, twenty lights, and forty lights. The smallest size will occupy the space of a small trunk, and the sizes of the batteries increase in proportion to their power. They can be put in any part of the house, from cellar to garret, or in the vaults under the sidewalks. The current in the batteries will supply the number of lamps they are intended for for five hours. Thus, a twenty-light battery will supply twenty lamps for five hours, or ten lamps for ten hours. A meter registers the flow of electricity through the battery, and also acts as an automatic cut-off when the battery is fully charged. Mr. Brush contends that the batteries will improve with age; but whether

they do or not will be the company's affair, for none will be sold. They will be put in houses and the lamps supplied without charge. The cost of the light, according to Mr. Brush, will not be more than that of gas, at which price it is expected to put in batteries as fast as they can be made. The light needed by an ordinary four-story house twenty-five feet wide, does not average in winter fifteen lights for five hours.

Contracts for lighting by this system have been made with a number of persons, and the batteries are promised within the next three weeks. Among other places, the Central National Bank, some of the stores along Broadway, and the Madison Square Theater have been wired by the company for the new light, and are now awaiting their batteries. At the Madison Square Theater it was said yesterday that not only would the light be better, especially in summer, as it gave out no heat and did not consume the oxygen of the air, but it promised to be twenty-five per cent. cheaper than gas. The Boston factory of the company is now turning out Swan lamps at the rate of 10,000 a week. As there is no work to be done in the streets to introduce this system of lighting, there is no reason why the work should not proceed rapidly after the batteries are received. From the same batteries power can also be taken for running small motors for sewing-machines, lathes, &c. The whole system of batteries, lamps, and motors can be seen by any one interested in the matter, at the company's offices, No. 853 Broadway, where they have been in operation all winter.

It is well known that upon the appearance of the first Brush storage batteries outside of the company's office, suits will be instituted for infringement of the Edison lamp patent, and of the Faure storage battery patents. About every expert and patent lawyer of prominence in the country is ranged upon one side or the other in the coming contest, which promises to be the most important ever fought over patent rights.

President Morton's Secondary Battery Tests.

The members of the New York Electrical Society assembled last evening in one of the lecture rooms of the Stevens Institute of Technology, Hoboken, to hear a paper read on the "Storage of Electricity," by President Henry Morton. The room was brilliantly illuminated by incandescent lamps, supplied by the Edison Electric Lamp Company. There was on the lecture table a two-horse power electric motor, manufactured by the Weston Electric Company, provided with measuring instruments to show the amount of electric current used, and a dynamometer to measure the power generated. The electric lamps and motor were supplied with electricity from a number of wooden boxes arranged in front of the lecture table and at the back of the room, which contained the electric storage batteries known as the Sellon-Volckmar accumulators. These were made in England, at the works of the Electrical Power Storage Company, of London, and have been for the last three months at the Stevens Institute, where they have been rigorously tested by President Morton as to their electrical properties and capacities.

President Morton opened his paper as follows:

"The subject which I propose to present to your notice this evening is that popularly designated the storage of electricity, and I have intentionally selected this title in announcing my paper, although it is open to some scientific criticism because it presents correctly the great practical relations of the subject, and is, I am sure, the title by which this subject will continue to be known. If we put our money into a savings bank, and are fortunate enough to get it out again when we want it, we may well say and consider that it has been stored and preserved for us, even if it should in the meantime have existed not as cash, but as Government bonds, mortgages or any other form of property; and in the same way if we put our electricity into certain boxes or batteries, and get it out again when we want it, we may very properly say that it is stored and preserved, even if, as a matter of fact, it has existed in the meantime as chemical energy and not as electric."

President Morton described the fundamental principles involved in the present methods of electrical storage, and then gave a brief historical sketch of the discovery of these principles and their application to this subject. He first described the gas battery of Prof. Grove; then the secondary battery of Planté; then the improvements of Faure, Swan, Sellon and Volckmar, culminating and combined in the battery used on this occasion and now controlled by the Electric Accumulator Company, recently organized in New York.

The peculiar structure of this battery was then fully shown, and it was seen to consist of plates, each made up of a fine lattice work of metallic lead filled in with a porous mass, which was in each alternate plate either metallic lead or the black per-oxide of lead. The manner of operation of these cells in charging and discharging was then explained and the important part played by the absorbed or occluded gases was pointed out. The tests made by the speaker showed that the cells would each yield a continuous current of about 32 amperes for nine hours, with an electro-motive force of about 2.2 volts. This quantity of current would supply 44 of Mr. Edison's incandescent A lamps of 16 candle power, and its intensity would make it necessary to employ only 50 of the cells to obtain sufficient electro-motive force to overcome the resistance of such lamps. The entire weight of each cell ready for work is 80 pounds, and thus, as a simple rule, it might be stated that for each light of 16 candles for one hour 10 pounds of battery should be provided if the battery were used solely as a reservoir to contain the entire current required. It was pointed out that the battery in many cases would only be required to act as a regulator, not storing the entire amount of electricity used, but only taking up a temporary excess and providing for a similar deficiency. Under such conditions it would not need to have capacity to supply more than one or two hours of current, and nearly all the current during normal working would go directly from the dynamo machine to the lamps, the fluctuations or momentary stoppages only being taken care of by the battery.

To illustrate this, the lights of the room were connected directly with a dynamo, and its current was caused to fluctuate so that the lights were extremely irregular. As soon, however, as the battery was also connected, so that any excess of current could flow into it, and any deficiency be supplied by it, the lights became perfectly steady.

In the next place, the use of the storage batteries as a means of driving street cars was touched upon. President Morton said that measurements which he had repeated (upon these batteries, whose weight was 80 pounds each,) a number of times, showed that each of them contained energy equal to about 1,800,000 foot-pounds, or such as could develop one-horse power for one hour, nearly. In other words, the energy stored in one of these boxes, if fully converted into mechanical work, could take a "bobtail car" full of passengers across town or from one end of the city to the other; in fact, could take the place of a horse for an hour. Another mode of expressing this amount of energy was to say that such a battery, if its energy could be applied to lifting it up, would be able to raise itself 20,000 feet, or four miles, up from the ground. To illustrate the operation of the batteries in driving an electric engine or motor, some experiments were made with one of these machines, made by Mr. Edward Weston, of Newark, and similar to one used by him to run the machinery in a department of his shop. The machine being connected with the storage battery, started at once into rapid motion, and a dynamometer, as well as instruments to measure the electric current, being applied, it was shown that the efficiency of the current in producing motion was very great. President Morton also stated that he had given the battery a practical test by placing some cells in his house and using them to operate electric lamps in his parlor and dining room. They had been in constant operation there for over three months, during which the battery had been recharged only four times. This recharging was effected once by removing the battery to the Stevens Institute, and since by connecting it with a telegraph line running between the institute and his house. According to his measurements, this battery had fully double the capacity of the Faure battery, and many times the capacity of the Planté battery, or of the Cabath cell or other modification of the Planté apparatus, and, while much remained to be done in the improvement of its construction and in the development of appliances necessary for its ready use, yet it had certainly reached a remarkable degree of efficiency already.

Bichromate Batteries.

M. Luigi Ponci, Director of the Technical Institute at Coma, thus describes a new bichromate battery made by him: It is composed of 1 kilogram of bichromate of potash, 4 liters of water and 2 liters of chlorhydric acid. The bichromate is crushed and dissolved in boiling water. After being completely dissolved, the whole of the acid is added to it. In this way a liquid is obtained containing a mixture of chloride of potassium and bichromate of potash. The use of this liquid prevents the formation of crystals in the battery. The battery is contained in a wooden case, lined inside with lead and holding six glass jars of rectangular form, the bottoms of which are pierced. These jars rest in the case on sheets of glass, which allow the liquid to circulate. The case is furnished with a leaden syphon tube, with which the battery can be charged and discharged. The elements are composed of a sheet of zinc and two plates of carbon. The two poles thus obtained are insulated from one another by a small band of India-rubber and compressed into a solid block. A case of six cells will give a current of the same intensity as six Bunsen cells (small size) for two hours. With three cases an Edison eight-candle lamp of small resistance can be kept alight, and with eight cases a good arc light can be maintained.

Telegraphs of the Ancients—From the Fall of Troy to the Battle of Waterloo.

On Wednesday evening, March 14th, Mr. Alderman W. H. Bailey delivered a most interesting lecture on the above subject at the Museum and Art Gallery, Peel Park, Salford, England, Mr. Alderman Bowes in the chair.

After a few opening remarks by the chairman, Mr. Bailey then delivered his lecture, from which we make the following extracts, which will doubtless be appreciated by the general reader.

AMERICAN AND AFRICAN SIGN LANGUAGE.

We are told by Lubbock and other writers of the history of civilization that many savage tribes, by reason of their poverty of word language, are compelled to carry on a conversation by signs. Some have thought that certain of these tribes are entirely without language, but this seems extremely improbable. The statement may have arisen from the fact that in all countries inhabited by savages the number of languages is very great, and hence there is a great advantage in being able to communicate by signs. James, the American traveler in the Rocky Mountains, mentions that several tribes under the influence of one great chieftain, were totally ignorant of each other's voice language, insomuch as it was no uncommon occurrence to see two men of different nations sitting upon the ground and conversing freely by means of the language of signs. Fisher, another traveler among the American Indians, mentions a language of signs, however, by which all nations and traders can understand one another, and they always make these signs when communicating among themselves. The men, when thus talking together, sit cross-legged like Turks, and communicate with each other with a speed and with a definiteness which would even be understood by a deaf man. For instance, Fisher says: "I meet an Indian, and wish to ask him if he had seen six wagons, drawn by horned cattle, with three Mexican and three American teamsters, and a man mounted on horseback. I make these signs: I point 'you,' then to his eyes, meaning 'see,' then hold up all my fingers on the right hand and the fore-finger on the left, meaning 'six'; then I make two circles by bringing the ends of my thumbs and fore-fingers together, and holding my two hands out, move my wrist in such a way as to indicate wagon wheels revolving, meaning 'wagons.' Then by making an upward motion with each hand from both sides of my head I indicate horns, signifying 'horned cattle.' Then by first holding up three fingers and extending my right hand below my lower lip and moving it downwards, stopping it midway down the chest, I indicate 'beard,' signifying 'Mexican.' And in this way, and by other similar signs and motions, I ask the Indian, 'You see six wagons, horned cattle, three Mexicans, three Americans, one man on horseback?' If he holds up his fore-finger and lowers it quickly, as if he were pointing it at some object on the ground, he means 'Yes'; if he moves it from side to side, on the principle that people sometimes move their head from side to side, he means 'No.'" Fisher says it takes about the same time to make these signs that it would take to ask the question verbally. The bushmen of South Africa, we are informed by another traveler, intersperse their language with so many signs that they are perfectly unintelligible in the dark, and when they want to converse at night they are compelled to gather round their camp fires. The celebrated traveler, Burton, says of a tribe of North American Indians, who possess so scanty a vocabulary that they cannot talk in the dark, that, to make a stranger understand them, they must always repair to the camp fire for a "pow-wow."

TELEGRAPHS BEFORE THE CHRISTIAN ERA.

For purposes of war and defense, methods of communicating from distant places have been used in all historic times, varying very little in character, and distinguished more or less by ingenuity. Bells, torches, flags and symbols have been used for purposes of communication from the earliest known periods. The Egyptians had signals to indicate the rank of important officers of state, many of which signals have been discovered in the excavations among the ruins of their great temples and monuments, and in the carving upon their sculptures. Among the Greeks, the Athenians had an owl and the Thebans a sphinx upon their banners and standards. And we are told that by using these emblems and signs in a manner understood by the various companies of soldiers in war, the standard-bearers were enabled to telegraph such orders as "advance" and "retreat," and to control other important military manœuvres. The use of these emblems in indicating the position of companies and regiments, in guiding friends and warning foes, was of as much advantage to the soldiers of the old days as the numbering of the houses in the streets is to us in these later times. Indeed, this use of emblems, not only among the ancient Greeks and Romans, and even the Egyptians, but down to our own days, has given rise to the art or science of heraldry. In this way were the barons and knights of old, as well as the commanders of famous legions, enabled to emblazon various devices on their coats of arms, many of which we still see displayed by those who are proud of their family blood, and of what stock they claim to belong to. On some occasions the device would be carefully prepared and thought out; in other cases, the symbol would be something at hand which had been seized in an emergency and lifted up as a rallying point for the people, and afterwards adopted from the attachment which clung to it as an object identified with patriotic deeds. One of this sort must have been the Persian blacksmith's apron, which, for many years until the Mohammedan con-

quest, was the standard around which the people rallied to resist the invader. As I have indicated, these banners and emblems were used not only to gather the troops together, but as telegraphs, to communicate the plan of operation in warfare. Fires by night and pillars of smoke by day, seem to have been used by both most civilized and savage peoples in all ages for transmitting messages. Various Roman writers mention different methods of communicating by means of torches. Julius Africanus says "substances were made use of in making the torch fires;" and some writers have thought that these fires and torches may have been of different colors, thus enabling the Roman generals to ring the changes in spelling words and in sending messages.

ALPHABETICAL TELEGRAPH OF THE GREEKS.

Probably one of the most ingenious telegraphs of ancient times was one used by the Greeks. The Greeks had a very good method of indicating the time of day by a clepsydra, or water clock. Indeed, the idea was the same as in the old-fashioned hour-glass; only, instead of sand being used, observations were made by the fluctuations of the water. I will now endeavor to describe one of these clocks, a model of which we have on the table here. You will be kind enough to imagine two of these water clocks, which have been regulated for the floats to descend at exactly the same speed. They have been made, to use a scientific term, synchronous—that is, made to keep equal time. We will imagine one of these instruments placed at night, with the sender of a message, on the top of a mountain, and another on a distant hill, say, two miles away. There we have them, sender and receiver. When a message had to be sent, the sender would hold his torch up. That was the signal for the receiver to prepare his instrument, and set it to zero by filling up with water. The sender would hold up his torch twice. This was a signal that he had permitted his clock to start running down; that is to say, for the water to escape by means of a faucit at the bottom. The receiver, seeing this signal, would at once allow his water clock to begin running down, and so both clocks would go on doing this at the same speed. Then, when the sender held up his torch again, it was a signal to stop. The receiver would stop his instrument and look on the stem for the letter of the alphabet which the sender meant to indicate. And thus, by repeating the operation the needful number of times a message could be spelt out with great facility. It is very remarkable that this ingenious water clock telegraph of the ancients, with a slight modification which I will explain later on, was similar to one of the first alphabetical telegraphs in this country, introduced by Mr. (afterwards Sir) Francis Ronalds, about the time of the battle of Waterloo. Instead of using water clocks, Mr. Ronalds permitted two clocks, with weights and wheels, to run down, having, indeed, in his mind exactly the idea which the old Greeks had over 2,000 years ago.

FLASH-LIGHT TELEGRAPH.

A new departure in torch telegraphy was made in the Shetland Isles, at the beginning of this century, by the Rev. James Bremner, to whom the Scottish Society of Arts presented its medal for his invention. By the use of a single torch the reverend gentleman was enabled to send messages. This was done by alternately exhibiting and concealing one torch. Indeed, so far as I have been able to learn, Mr. Bremner may be considered to be the inventor of the flash-light system, which, in a modified form, is now used on the vessels of the British navy, and also by our army in the field at night. It was used in the recent campaigns in Abyssinia, Afghanistan and Egypt. This alternate exhibition and concealment of the light enables a word to be sent nearly as fast as a man can write. No doubt most of you are aware that a flash-light telegraph is made by a piece of "looking-glass," and used when the sun shines. This is called the heliograph Messages are sent by simply placing this looking-glass at such an angle as to reflect the sun's rays. By means of a telescope messages have been received in this way from a station ten miles away. The Morse code of the dot and dash system is used for the flash-light purposes, and by alternately exposing and concealing the looking-glass by day and the lantern by night, messages can be sent, as I have said, nearly as fast as a man can write. It seems that Mr. Bremner, the Shetland clergyman, put his plan into operation, and was enabled to communicate at night between one island and another, and he established two stations, one in Scotland and the other in Ireland, and was thus in a position to telegraph between points twenty miles apart.

WASHINGTON'S TELEGRAPH.

During the American revolutionary war, or war of independence, as it is called, many methods of signaling the approach of the enemy were used. Among the various plans was one of which this model on the table is an illustration. This telegraph consisted of a post or mast which was portable, a tub or barrel placed on the top, a movable flag on one side, and a basket on a bracket near the top were used to signal with. By ringing the changes with the flag, the basket and the barrel, and by moving the flag up and down, various signals could be sent. Altogether, I believe that fifty different signals could be given by this means.

SEMAPHORE TELEGRAPHS.

We now come to the semaphore signals, which are used even to the present day, chiefly for railway purposes. Probably the most ingenious and among the first of this class of telegraphs was that invented by the brothers Chappé. It appears that this invention is due to the affection entertained by the two brothers for each other. They were placed as students at different schools, a mile and a half apart. They were inconsolable at being thus separated, and, by means of pieces of wood exposed from the back windows of each school, the brothers Chappé contrived to talk to each other. In their first system of telegraphing, they arranged a code of signals which enabled them to send 192 different messages, this being done by means of instruments similar to the one I now have on the table. As the ingenious brother became older, the invention was placed before the Government, and was tried just before the Revolution in 1791. The people, however, looked upon the invention as only another means of increasing the power of the Government and the aristocracy. The introduction of the invention was opposed; the people destroyed the telegraph stations, and the inventors barely escaped with their lives. A second attempt shared the same fate. Again the various telegraph stations were burned to the ground. The brothers Chappé, however, continued their efforts, and in 1793 the Government adopted the system. Circumstances were favorable. The telegraph, having been adopted, was fortunate enough to communicate to Paris the news of a great French victory; and now the brothers Chappé were considered part and parcel of the glories of France. This message was transmitted from the frontier to Paris: "Condé is taken from the enemy," to which the Directory replied: "The Army of the North deserves the gratitude of the country." These messages ran like an electric shock throughout the convention and throughout Paris. The once-abused telegraph was now the pride of the nation, and its inventors were worshiped as public benefactors. The system invented by the brothers Chappé soon became universal on the continent. A line was carried from Paris to Lille, and two minutes only were occupied in transmitting a word. In 1802 the system was adopted in Denmark. Shortly afterwards it was made use of by the Governments of Belgium, Sweden and Germany. Mahomet Ali erected stations on this system from Alexandria to Cairo. The most expensive series of stations was constructed in Russia by the Emperor Nicholas. A line of towers was erected from the German frontier, through Warsaw, to St. Petersburgh. This line embraced 220 stations, at each of which were six men, so that 1,320 men were employed on this route, besides those who had charge of the general administration. The erection of these towers cost the Russian Empire millions of pounds sterling. The system was only finished and got to work so comparatively recently as the year 1858; and, after being in operation but a very short period, it was completely superseded by the electric telegraph. The towers are still standing, silent monuments to the ingenuity of the past. Scarcely any description is required of the Chappé semaphore telegraph. The method of manipulating the arms was by means of levers, similar to those now in daily use on our own railways. Occasionally the system was used at night by placing lanterns on the end of the vanes. Men were stationed along the line of communication with telescopes. And thus, by means of known changes, various codes could be worked at great speed. In France, along the route between Toulon and Paris, a distance of 475 miles, there were 120 stations; and it is said that so complete were the instruments made that over 82,000 different signals could be sent. The Prussian system of semaphore signals, a model of which we have on the table, was introduced in the year 1782. It will be seen that this is but a modification of the French system.

ENGLISH SEMAPHORES.

Forty thousand signals could be sent by this means. The English semaphore shutters, or Louvre telegraph, were invented by Lord Murray in 1795. The instrument, as you see here, consists of six shutters working on pivots. Sixty-four distinct signals could be sent by this system from London to Dover in ten minutes. These were placed along the coast, leading to stations inland, and were in general use in this country up to the invention of the electric telegraph. Messages could only be sent in the daytime by this system. It is mentioned that after one of Wellington's victories over the French, when the news was being sent to London, the sender at the coast end began the signal with the words, "Wellington defeated——" A dense fog prevented the rest of the message being seen, and the result was great consternation in London and a panic on the Stock Exchange. When the fog cleared up the following day, the rest of the message was received, and the message then read, "Wellington defeated the French." I remember, when I was a boy, this system being used between Holyhead and Liverpool for sending news of the arrival of the American mail. On the vessel being sighted at Holyhead, the news was sent forward right across Anglesey to Puffin Island, thence to the Great Orme's Head, thence right along the Welsh coast to Parkgate, across the mouth of the River Dee, and thence to Liverpool. For many years the intelligence sent in this old-fashioned way from Holyhead to Liverpool was sent from Liverpool to Manchester by electric telegraph. Many of the old stations on the line of route between Holyhead and Liverpool are still in existence, though their occupation is gone.

THE RONALDS ELECTRIC TELEGRAPH.

The model on the table here is one of the system invented by Sir Francis Ronalds. There are many points of similarity between it and the Greek water-clock telegraph. Sir Francis recommended the use of clocks with wheels, one at the sending and the other at the receiving station. These clocks were made to drive dials at exactly the same speed—to work isochronously. The alphabet, as you see, is painted on the dials which revolve behind a little hole, showing one letter at a time. The sending and receiving instruments are coupled together by means of an electric wire. Pith ball electrometers are hung in the front of each dial. On the balls being extended by means of an electric current, this signal would cause the receiver to allow the clock to run down. Another signal causes the clock to be stopped. The sender and the receiver, starting and stopping the clocks in this way, were enabled to send and receive messages in a comparatively quick manner. This, although not the first electric telegraph, is one of the first invented that was of a workable character. The inventor communicated his ideas to the War Office soon after the battle of Waterloo, and he received an intimation from the authorities there to this effect: "Now that the war is over, telegraphs will be no longer required." (Laughter.)

The telegraphs I have endeavored to describe are chiefly those used for the purposes of war. Even in this country it was considered by official persons that the arts of peace would not be much benefited by those quick methods of communication. It is not within the scope of the lecture this evening, nor have we time, to consider modern telegraphy. For the present, I may be permitted to say that, according to Mr. W. H. Preece, 400 words per minute can now be telegraphed along one wire, as a result of the recent improvements of duplex and quadruplex circuits in connection with automatic instruments. When the telegraph service was taken over by the Government a few years ago, 126,000 messages were sent per week. Now the weekly number is over 600,000. In press work the increase is most marked, the rate in this period having risen from 5,000 words per day to nearly 1,000,000—that is to say, 340,000,000 words of press messages having been delivered during last year. England has not a monopoly of this useful agent. All prominent countries exhibit corresponding growth. The Japanese even, dispatch 200,000,000 messages a year. The telephone is another wonderful advance in telegraphy. To enable people to speak in actual words, with the accent and exact tone, to their friends miles away, is a splendid scientific triumph. The electric telegraph is one of the great mutually dependent blessings of these modern days. It is powerful in promoting the uses of civil life, it is blessed in strengthening the arts of peace.

Underground Wires.

EXPERIMENTS AT CHICAGO—THE MAYOR AND THE MUTUAL UNION—THE POSTAL TELEGRAPH COMPANY—VIEWS OF WESTERN UNION PEOPLE.

There seems to be an impression that Chicago is to be the pioneer city in constraining the telegraph, telephone, and other electric companies to lay their wires and cables underground. It arose, probably, from a rather summary proceeding a few weeks ago by the Mayor, who ordered all the wires belonging to the Mutual Union Company to be cut, except one which ran to the office of a newspaper supposed to be friendly, and likely to be useful in the city election, then near at hand. But this heroic treatment of the telegraph-pole nuisance (which lasted but two or three days) was occasioned, if not justified, by the peculiar conditions under which the Mutual Union Company secured the right of entry into the city. A brief account of the relations between the Mutual Union and the city government will lead up naturally to the present status of the underground telegraph system in Chicago, which, I am sorry to say, seems to be

"Remote, unfriended, melancholy, slow."

THE FIRST ORDINANCE.

During the time the Mutual Union, as an independent and competing telegraph company, was making its way westward, the Chicago Common Council, with a rather suspicious foresight, passed an ordinance declaring that "no person shall hereafter erect, construct, or put up any telegraph pole, telegraph line or wire, or electric conductor in any street, avenue, or alley within the corporate limits of the city of Chicago, under the penalty of $100 for each and every offence; and each and every day any such telegraph pole, line, wire, or electric conductor shall be continued and maintained after the first conviction shall constitute a new and separate offence."

When the Mutual Union was ready to set up its offices in Chicago, it was confronted with this ordinance, and found it necessary either to construct an underground system within the city limits, as required by other ordinances passed at the same time, or else obtain a special exemption from the Council. It chose the latter course, which is said

to have cost the company in the neighborhood of $25,000. It secured a permit to erect poles and string its wires in the usual way, notwithstanding the huge network of wires which already lined both sides of the principal thoroughfares. But it was agreed that all these new poles and wires should be taken down at the expense of the company on or before March 1, and the failure of the company to do so was to give the Mayor the right to have them cut down. Of course, the company did not carry out its part of the agreement, thinking, perhaps, it hadn't enjoyed its money's worth, and when the time had passed Mayor Harrison ordered the wires to be cut, with the exception aforesaid. Then the company went into the United States Court to ask for an injunction restraining the city from doing what it had already done. It was a case of locking the door after the horse had been stolen. That is the view which the venerable Judge Drummond took of it. He said, in effect, that he couldn't approve of the means Mayor Harrison had taken, but he didn't see how he could undo what had been done, notwithstanding the elastic and comprehensive character of a legal injunction, and he instructed the company to seek its remedy in a suit for damages. This preliminary lawsuit, however, had the effect to bring about a conference between the Mayor and the officers of the Mutual Union Company, and the result was a "compromise," whereby the company was permitted to patch up its wires and maintain the overhead system till May 1, the date fixed for the magic disappearance of all overhead wires in this city. In making this compromise, the Mayor exercised legislative functions which may surprise New York readers, but to which the people of Chicago have become entirely accustomed, if not reconciled. Here began and ended the compulsory system of underground telegraphy in Chicago.

OTHER ORDINANCES.

I append below the other ordinances passed at the same time with the one already quoted, bad grammar and all—only premising that the official grammar of the Chicago Common Council is not one whit worse than its reputed morals:

"SEC. 2,023. No person, company, or corporation to whom permission and authority has heretofore been given to erect and maintain telegraph poles and lines in the streets of the city of Chicago shall, from and after the first day of May, 1883, maintain or use any telegraph pole, telegraph line, wire, or electric conductor, in any street, avenue, or alley in said city under the penalty of $50 for each and every day such person, company, or corporation shall maintain or use any such telegraph pole, line, or wire, or conductor after said day and year last aforesaid.

"SEC. 2,024. From and after the first day of May, 1883, every telegraph line or wire or electric conductor used and operated within the corporate limits of the city of Chicago, shall be laid under the streets of said city, and at such depth from the surface that the necessary excavation incident to laying or repairing the same shall not expose or endanger any water or gas pipes, sewers, or drains, or any parts thereof.

"SEC. 2,025. Such wires or conductors shall in no case be placed at a greater distance from the curbstone separating sidewalks from carriage-way than four feet, except in crossing streets running transverse to the direction of said lines, when such crossing shall be made in the shortest straight line or in making necessary connections with buildings and stations.

"SEC. 2,026. The method employed in laying said conductors shall be such that it will at no time be necessary to remove so much of the pavement, or to make such excavation, as to materially impede traffic or passage upon sidewalk or street during operation of laying or repairing said conductors, except when in crossing streets transversely, where it shall be permitted to remove the pavement for a width not exceeding two feet, and in the nearest straight line from corner to corner. In no case during the general hours of passage and traffic shall passage be interrupted thereby for a longer period than one hour.

"SEC. 2,027. The work of renewal and replacement of the pavements in any and all of the streets, avenues, highways, and public places in and through which the wire of any telegraph company shall be laid, shall be subject to the control and supervision of the Commissioner of Public Works, excavations in any and all of the unpaved streets, avenues, highways, or public places shall be subjected to like control and supervision.

"SEC. 2,028. The space selected for placing said wires, in every case being limited as to direction and general position by the foregoing provisions, shall not exceed two feet in width by two feet in depth."

THE POLES STILL STANDING.

After a careful reading of these ordinances the South Sea Islander would conclude that on and after May 1 next—a few days hence—Chicago will be free from the annoyances and dangers inseparable from the high poles and scores of closely strung wires found in all large cities of this country. As a matter of fact, no step has been taken, so far as I can learn, to transfer the wires under ground by the 1st of May, or at any subsequent date The wires will not move. Mr. Clowry, the superintendent of the Western Union Company, says plainly that the wires belonging to that company—and they are the bulk of all the wires in the city—will not be put under the ground. He is careful to add, of course, that he does not say this in a defiant spirit, but that he has persuaded himself that the underground system is not practicable for so large a number of wires as are used in Chicago. He has been sitting up o' nights studying all sorts of plans, and has so far convinced himself of the impracticability of the underground system at this point that he would give up his position—so he says—rather than be responsible for its successful establishment. When confronted with the undoubted success of underground telegraphy in London, he replies that no such number of wires are used in London as here, and that the telegraph wires in England are operated by short open circuits not in vogue here. As to Paris, he dwells upon the exceptional facilites afforded by the Parisian sewers, and he has a ready explanation for success in every other city which may be mentioned as having the underground system in successful operation.

One thing is certain: The telegraph poles and wires in Chicago will not disappear suddenly from that part of the face of the earth included within the corporate limits of Chicago. It is said that the Mayor has held conferences with the officers of the various telegraph and telephone companies, and has given them to understand that *he* will be satisfied with the adoption of shorter poles and overhead cables, which shall hold from eighteen to thirty-six wires each, and shall be strung by loops on a single stout wire. The theory is that such cables can be quickly loosened from their fastenings, and dropped down low enough not to interfere with fire-ladders and fire-escapes when they are brought into use. This is a cool assumption that the interference of the wires in case of fire is the only objectionable feature about them. The telegraph and telephone companies are proceeding to hang these cables, which are in use to some extent in New York, and evidently they are under the impression that the Mayor will suspend the operation of the law. He may do so, and the people may acquiesce as usual. If popular protest shall be loud enough to reach the high official ear, the city authorities may go into court and ask to be constrained into enforcing the law, or the telegraph companies may anticipate such action by going into court first and asking that the authorities be restrained from enforcing the law. In either case the telegraph companies will set up their vested rights under the United States laws, the State statutes, and the original city ordinances giving them right of way within the city limits. The Western Union claims broad privileges under the United States statute of 1866, which gives the Government priority in the sending of messages, authorizes the Postmaster-General to fix rates, and provides for Government purchase by appraisement in dealing with such companies as accept the terms of the law. The Western Union filed its acceptance, and thus secured a right of way on all the military and post roads. It will be for the courts to decide how far this law will govern the municipal regulation of telegraph lines, which is believed to be still an open question, though the decisions, so far, have not sustained the hopes of the telegraph managers. The Illinois laws expressly confer upon the incorporated cities and villages the authority to direct any alteration in the location and direction of poles as they see fit. If it were merely a question of adopting the underground system for Chicago, it is probable that the Western Union would not resist the law, since the company assumes a large part of the extra expense by adopting the cable system for overhead wires. But it is naturally apprehended that the successful operation of the underground system here, and acquiescence in the city's compulsory proceeding, would lead to a demand for carrying the wires underground in all the cities and towns of the country. That would involve an enormous expense to the company, which it will avoid as long as possible.

A TWO MILES' TRIAL.

Aside from the laying of two or three of the Fire Alarm Telegraph wires under ground, which was done by Prof. Barrett, the City Electrician, several years ago, the only completed effort at underground telegraphy in Chicago is a stretch of two miles, constructed for the Western Indiana Railroad Company.

The work was done by the Western Electric Company, of this city. It consists of the usual cable made by that concern (which in this instance contains twenty wires), laid in a common wooden box, about eight inches square, which was put down near the curb of the street, and about a foot below the surface. This underground cable has been in use about eight months—not long enough, it is claimed, to test the durability of the plan adopted. But it has worked in an entirely satisfactory manner. There was some dispute about the payment for the work. The Western Electric Company sued, and the Western Indiana took advantage of a temporary break to set up non-fulfillment of the contract. It is admitted, however, that the break was located and repaired immediately, and that the wires are working all right. If the Western Electric Company's system shall prove efficient, it will remove the most serious objection which the telegraph and telephone companies urge against underground telegraphy, viz., the cost. The cable used by the Western Electric Company consists of a common lead pipe, through which copper wires, wrapped in cotton, are drawn. The pipe is then heated, and paraffine is forced into it by pressure from carbonic acid gas till it is completely filled; then the joints are sealed. This process is much cheaper than the gutta-percha and "kerite" (the Day secret), used in the other cables. The cost of the cable laid under ground for the Western Indiana Railroad Company probably does not exceed by more than 25 or 30 per cent. the cost of stretching the same number of wires overhead. The cost of the kerite and gutta-percha cables is equal to 100 per cent. more than the ordinary construction of poles and wires, and the cost of the laying of such cables under ground would be increased by the cost of excavating and of the conduit adopted.

Lieut. Greene, of the Army Engineer Corps, who recently investigated the underground system for the District of Columbia commissioners, reported that the cost of the cable system adopted by the telephone companies in Boston, with the special purpose in view of overcoming the retardation, was more than six times as much as the same number of conductors would cost on fixtures overhead, but he also came to the conclusion that the estimated cost of the underground cable, as a rule, is altogether excessive. In his report he declared the underground system to be "perfectly feasible for trunk lines," expressed the conviction that immunity from storms and other overhead dangers may make it cheaper in the end than the overhead system, and recommended that the Commissioners pass an ordinance prohibiting the further erection of any poles, except in the alleys for the accommodation of individual telephone lines. If such an ordinance be passed for the control of electric wires in Washington, it is to be hoped that it will be more efficient than the Chicago ordinance promises to be.

ANOTHER EXPERIMENT.

The most important experiment in underground telegraphy which has been undertaken in this city is now in process of construction by the Chicago Sectional Electric Underground Company, which has purchased the patents and adopted the plan of the Philadelphia company of the same name. This company has secured a right of way from the city limits to a central point in the business district (about four miles), and is laying a cast-iron box, four inches square, as a conduit. This box is laid on the side of the street opposite the water mains, and at a depth of twenty inches. There is to be a manhole at every street corner, four by six feet in dimensions, with an eighteen-inch opening at the top, which is to be covered with perforated iron, to furnish light and ventilation. There is to be laid in this conduit a carrying wire (to take in subsequent wires), which is to be divided off in sections of a block, and joined at the manholes. The wires of the Postal Telegraph Company are to come into Chicago through this conduit. In addition to the carrying wire provided by the company there are to be four shelves of copper or wire-cloth, upon which cables may be laid. Each tunnel will hold 50 electric-light wires, and from 400 to 500 telephone and telegraph wires. Openings are to be provided at intervals of 20 feet to tap wires for lighting, telephone, and telegraph purposes. One mile of this conduit has already been completed, and the system is to be subjected to a practical test in a few days by an exchange of telegraph messages between New York and Chicago, and telephone messages between Cleveland and Chicago. The test is to be conducted under the supervision of Professor Elisha Grey, the inventor of the wire and process used by the Postal Telegraph Company, and Prof. Barrett, representing the city; a successful issue of the test will show that wires can be operated under ground for the distance required by large cities at a small cost of maintenance.—*The Post.*

A Tale of Telegraph Ticking.

A well-to do young man recently married and started West on his bridal tour. The happy young couple were breakfasting at a station eating-house. During the repast two smart Alecks came into the dining-room and seated themselves opposite the contracting parties. They were telegraph operators. By delicate poising of their knife and fork they were able to make sounds in close imitation of telegraphy. In the mystic language of the key one said unto the other:

"Ain't she a daisy, though?"

The party thus addressed replied by clicking off:

"Wouldn't I like to hug and kiss her, the little fat angel?"

"Wonder who that old bloat is that she has married?"

"Some gorgeous granger, I reckon!" replied the other.

The groom stood it until forbearance ceased to be a virtue, when he also balanced his knife, and click, click, it went in rapid succession. It was intelligible to the very cute twain that had recently made fun of its author. When interpreted it read:

"DEAR SIRS: I am Superintendent of the telegraph line upon which you work. You will please send your time to headquarters and resign your respective positions at once. Yours, Superintendent of Telegraph."—*Ex.*

Interesting to Telephonists.

PHILADELPHIA, April 14, 1883.

Editor Review:

DEAR SIR:—A suit of much importance to the Bell Telephone Company of Philadelphia will soon be called for trial. The facts, as near as I can learn them, are as follows: The line work of the company is almost exclusively housetops, they having but fourteen poles, which, we understand, are set in private property. The city councils has never granted them any privileges, other than to pass an ordinance permitting the company to exist in the city as best they could. In consequence of this, the housetop routes of wires are many, and often quite voluminous. One of these routes of sixty-seven wires passes diagonally across the building at the southeast corner of Thirteenth and Filbert streets, from a pole in the rear alley (a private street, I believe, owned by Messrs. W. F. Potts & Son, called Silver street) to a fixture on the northwest corner of the same streets, clearing the northeast corner about five feet (no wires being attached to it). One of the occupants, Mr. Gideon Sibley, who tenants the upper portion of the building, took it into his head one day that he must have a telephone, but never dreamed of paying anything for it. He claimed that the wires were in his way by being only five feet above the roof. The telephone company then raised the wires to a height of ten feet above the roof. Mr. Sibley then gave them a formal notice to remove the wires, which the telephone company declined to do. At the expiration of the time stated by Mr. Sibley that the wires should be removed, finding them still in position, he took a long pole and managed to cross the center wires in the lot, and then tied the entire body with a piece of wire. He could not draw them together close enough to bunch them all, hence his desire to cross those in the center with the pole. Among the wires interfered with were two connecting the Baldwin Locomotive Works, one with the Exchange and the other with their down town office. They were much inconvenienced, and one of the firm executed an affidavit to the effect that their wires were in trouble; that they had been and were still being damaged in consequence; that the telephone company were ready to testify that the cause of the interruption was malicious mischief on the part of one Gideon Sibley.

On the strength of this a warrant for Mr. Sibley's arrest was issued. He was taken into custody and released on $500 bail to appear for hearing. At the hearing he was bound over in the sum of $600 to appear at court to answer the charge of malicious mischief. The telephone company took the ground that the owner of the premises only could serve them with a proper notice to remove the wires, for the reason that the premises are occupied by three or four tenants, each renting directly from the owner, and Mr. Sibley had no individual claim upon the air ten feet above the roof. I will post you as to the result of the trial.

PHILA.

The Postal Telegraph Company.

A change is about to be made in the Postal Telegraph Company, which change will, its officers say, contribute largely to the success of its plans. The change of basis of the affairs of the company is caused by the sale of the stock owned by Mr. John B. Alley, of Boston. Mr. Alley owned a controlling interest in the company, and has always evinced a great interest in its affairs, but, being advised lately by physicians to give up all active business, decided to sell his stock, which has been purchased by a syndicate of capitalists of New York and Boston. Their names have not been made known as yet, as the negotiations have not been fully completed. Vice-president Henry Cummins, of this city, said yesterday that he did not think that there would be any change in the executive officers of the company, except in that held by Mr. Alley, although a new board of directors would probably be chosen. With the new administration Mr. Cummins said that lines of the wires would be put up immediately to all the larger cities of the United States. The capitalists who had taken hold of the matter were men whose sole interest was for the welfare of the Postal Telegraph Company. The Postal Telegraph Company was organized in June, 1881, with a capital stock of 210,000 shares at $100 each. Its officers are Alanson W. Beard, of Boston, president; Henry Cummins, vice-president; George L. Shorey, of Boston, second vice-president; and John B. Alley, of Boston, treasurer. Already one wire through to Chicago is paid for, and will be ready for business in a short time.

Foreshadowing of Telegraph.

In Baily's Dictionary, edition of 1730, one hundred and fifty-two years ago, the following passage is given under the word "Lodestone":

"Some authors write that, with the help of the magnet, or lodestone, persons may communicate their minds to a friend at a great distance; as suppose one to be in London and the other in Paris, if each of them has a circular alphabet, like the dial-plate of a clock, and a needle touched with one magnet, then, at the same time that the needle at London was moved, that at Paris would move in like manner; provided that each party had secret notes for dividing words, and the observation was made at a set hour, either of the day or the night; and when one party would inform the other of any matter, he is to move the needle to those letters that will form the words that will declare what he would have the other know, and the other needle will move in the same manner. This may be done reciprocally."

The reader will please consider that, at the time this book was printed, *magnetism* was derived solely from *lodestone;* that electricity was only known "as a power or property whereby amber and a few other substances attracted straws and similar light bodies;" that it was not until twenty-one years afterward that Franklin raised electricity to the dignity of a science by proving its identity with the terrible thunderbolt; that galvanism was unknown until 1790; that the next great step—the discovery of electro-magnetism—was not made until 1820; and that the final triumph—the invention of the electro-telegraph—was not achieved until 1847.

When we consider all the above facts, this extract from old Baily seems, indeed, prophetic and inspired. It is, if possible, yet more wonderful that the process so minutely described by Baily is almost identical with that pursued in the manipulations of Wheatstone's telegraph—the telegraph generally used in England.

Registering Visitors by Electricity.

The Commissioners of the Cincinnati Exposition Society have decided to adopt a new style of register, to be worked by electricity. Instead of each of the nine registers recording separately, they are all to be connected with a dial in the office of the board. Each register is to be numbered, and each is to have five dials, on the same plan as a gas meter, so that each will record entrances up to 99,999. The work will require about three thousand feet of wire and a number of batteries. C. E Jones & Bro. are to put in the work for $450.

A consolidation of the two District Messenger companies of Boston has finally been completed, and is to take effect May 1st.

The new company is to be known as the Mutual District Messenger Company of Boston, and is capitalized at $250,000, $50,000 of which is Treasury stock.

A contract, covering a period of ten years, has been executed between the Western Union and District companies, and provides for the entire and exclusive collection and delivery of telegrams for the city of Boston.

The Telephone in Brooklyn.

In no place, probably, has the use of the telephone become more general than in Brooklyn. The business is now under the control of the Long Island Telephone Company, which has done as much during the past six or eight months as it did during all the previous periods of its existence. The large and rapid increase of wires on our principal thoroughfares has marked the progress made in the extension of the service. "We have doubled our subscription list since last July," said General Superintendent W. D. Sargent. "We then had 800 subscribers; we now have 1,600. We have extended our lines to Flushing, College Point, Whitestone and Bayside. We are building lines to Jamaica, Far Rockaway, Hempstead, Babylon and Patchogue, and we expect ultimately, probably during the summer season, to reach to the other end of the island. We have opened a pay station at Coney Island, and will have stations in all the leading hotels on the beach. In the city we have rebuilt lines with first-class poles, and in the past six months have added between 500 and 600 miles of wire. About 5,000 messages pass over the wires daily in this city, and between Brooklyn and New York the number is some 30,000 a month. We have established a connection with Fire Department Headquarters, so that an alarm of fire in the house or business place of any of our subscribers can be sent at once to headquarters. A great change has taken place since the latter part of 1881, when the company had only 101 instruments in use."

Action to Annul the Charter of the Mutual District Messenger Co.

Mr. Hiram McGonegal, one of the original incorporators and stockholders of the Mutual District Company, has made application to the Attorney-General for permission to bring suit against that company for the purpose of annulling its charter.

Mr. McGonegal claims that the whole capital stock, $250,000, was transferred for a patent of Wm. Fix for an improvement in burglar alarms.

This patent was afterwards offered by the patentee, it is alleged, for the whole United States for a mere nominal figure.

In their report to the Commissioners of Taxes and Assessments some year or so afterwards it is alleged, the company state that some $57,000 had been expended in construction, and that the balance of stock not represented by this cash amount was issued for patents which were speculative and of unknown value, and had never been used by the company and were not necessary to its success.

The practice prevalent in some district telegraph companies of bulletining through the numerous offices in a conspicuous manner employes who incur the displeasure of the management has resulted finally in a suit brought by Charles H. Porter, ex-manager of the Mutual District Messenger Company against Geo. V. B. Frost, the General Superintendent, for public defamation of character. Mr. Porter, it is alleged, while in the employ of the Mutual Company, was negotiating with another company for employment, whereupon he was discharged by the General Superintendent, and a printed notice posted upon the bulletin boards of the various district offices charging him with conspiring with the enemies of the company and forbidding him *entrée* to any of the offices of the company.

The case comes up Wednesday before Judge Ingraham in the Superior Court, and the result is anxiously awaited, as upon the verdict similar action in other cases is dependent.

Sir William Thomson follows Dr. Thomas Reid in ascribing to man six senses instead of five, namely, the sense of force, of heat, of sound, of light, of taste, and of smell.

Electrical Poetry.

The late Prof. Clerk-Maxwell was in the habit of recreating his mind from its severer task by penning amusing physio-comic parodies of well-known poems. One of the best of these was his electric valentine, which runs as follows:—

ELECTRIC VALENTINE.

Telegraph Clerk A to Telegraph Clerk B.

"The tendrils of my soul are twined
With thine, though many a mile apart;
And thine in close-coiled circuits wind
Around the magnet of my heart.

"Constant as Daniel, strong as Grove;
Seething through all its depths, like Smee;
My heart pours forth its tide of love,
And all its circuits close in thee.

"O tell me, when along the line
From my full heart the message flows,
What currents are induced in thine?
One click from thee will end my woes."

Through many an Ohm the Weber flew
And clicked this answer back to me:
"*I am thy Farad staunch and true*
Charged *to a Volt with love for thee.*"

$$\frac{dp}{dt}.$$

The inscrutable signature, $\frac{dp}{dt}$ is explained to be adopted from the fundamental equation of thermodynamics $\frac{dp}{dt} = J.\ C.\ M.$ (James Clerk-Maxwell.—*Ex.*

On Tuesday evening the 24th inst., our genial friend, Frank G. Beach, the well-known General Superintendent of the Central Midland and Western Telephone Co.'s at Chicago, was married to Mrs. Elizabeth Jackson, of Brooklyn, N. Y. After the ceremony at church, a reception and dinner was given at Mr. James Elliott's residence, the bride's home. The presents were numerous and very elegant. After dinner and dancing the happy party left for a tour South and West.

Telegraph Troubles in Chicago.

In obedience to the order of the Mayor the telegraph companies in this city have been gathering their wires into cables carried on short poles, and so arranged that they can be thrown to the ground in case of fire. On the 16th inst. the Council passed an order directing the Mayor to cause these cables to be removed at once.

Brush vs. Van de Poele.

In the United States Court at Chicago, on April 5, Mr. Charles T. Brush and others filed bills against the Van de Poele Electric Light Company and J. Irving Pearce to restrain them from using the Brush patents, issued October 23, 1877, for improved metal-plated carbons.

Forty years ago, when Peter Cooper was merely a business man, I used to see the sign upon a warehouse in Burling Slip: "Peter Cooper. Glue and Iron Wire." Next door to Cooper, and under the same roof, was seen the plain and unpretending sign, "Cyrus W. Field. Rags." Here a tall young man with a Yankee accent purchased paper stock for the New England mills, and here the chiffoniers and rag-pickers found a market for their gatherings. Under such circumstances Field and Cooper became acquainted, and eventually they united in the cable enterprise.

Mr. Fred. R. Place, of Hot Springs, Ark., has secured the agency of the Fuller Electrical Company for the State of Arkansas, and is about introducing the increasingly-popular modern improvement, the electric light, into that great and growing State.

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We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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Keeping Abreast of the Times.

The Trustees of Columbia College met recently and proved their ability to do more business in a given space of time than any similarly-constituted board whose sessions we have seen recorded. They refused the petition of the young women who desired admittance to the institution, but generously gave them permission to follow the college *curriculum* in the sanctity of their own homes, and then they trurned their attention toward enlarging the scientific scope of the School of Mines. The addition to the electrical department which they purpose to make constitutes a step in the path of practical progress which the boards of other colleges would do well to emulate. The average college is fitted with appliances in this field whose careful four years' study by the undergraduate will insure to him a task of four years' duration after graduation, to enable him to forget in order to school himself in the superior and altogether different methods that have been devised during the past decade.

Few will deny that the study of electricity is one of the most important that the student can engage in, and perhaps there is no branch of science that so baffles the inquirer as this. It is, therefore, the more necessary that he is supplied with the most modern appliances. Owing to the numerous theories that have been entertained regarding electricity, the nomenclature has been very confusing as well as misleading. Out of the old idea that electricity was a fluid has grown the term current as an expression of the electro-dynamic condition of a conductor. There are probably only a few men who, notwithstanding our comparatively slight knowledge of electricity, who do not believe that it is only a condition that matter assumes under certain circumstances and not matter itself. But it would be difficult to explain just what this condition is. We believe that the popular theory at the present time is that electricity, like heat, is molecular motion. If we take the movement expressed by the molecules of matter, the motion of heat is sluggish when compared with electrical molecular motion.

Prof. Gray says that the difference between the two motions may simply be in rate, or it may be in form, or in both; most likely in the latter. With heat it would seem that the molecule has an orbital or circular motion, and that their planes of motion do not coincide, as, for instance, in polarized light, are but like the unpolarized rays where the planes of vibration radiate in all directions. This would seem to be the case from the fact that a heated body expands in all directions. An electrical conductor does not perceptibly expand unless there is a conversion into heat. This would lead to the conclusion—possibly erroneous—that the molecular movement is in the same plane, and that the energy is propagated by the impact of one atom or molecule against another successively.

If electrical equilibrium is upset, electrical phenomena are obtained, and in certain cases advantage may be taken of this at whatever point chosen if the energy developed by nature's attempt to reinstate the electrical condition, for it is a fundamental law that the tendency is to return to the normal state of things. For it has been often demonstrated that we can disturb the electrical equilibrium at one point and obtain energy developed by such disturbance at another point, but the latter must, of course, be somewhere within what is known as the electrical circle.

All these points, though so well understood by the electrician, must prove of interest to the student, and the very fact that there remains so much to be yet discovered concerning the wonderful natural force, electricity is apt—if he is properly instructed—but whet his appetite to delve into pastures yet untraveled by the electrician and the scientist.

We hope that at no distant day we shall have collected in one spot every known electrical contrivance of value, in practical running order, and the most fitting place for such a collection would be in that portion of Columbia College known as the School of Mines.

Comparative Exhibitions.

Electrical exhibitions are becoming phenomenally popular just now. To the many which we have already enumerated must now be added a very important and, if rumor may be relied upon, a very interesting one, now being held in St. James' Hall, Manchester

A curious feature of recent electrical exhibitions has been the elaborate and painstaking display of the gas people. These distributors of noxious vapors and poisonous fumes seem to have misled themselves into the idea that "electrical exhibition" and "gas exhibition" are synonymous terms, and, as soon as an electrical exhibition is opened, at once send in their exhibits of gas-plant and apparatus without a word of apology.

If the manufacturers of India-rubber galoshes or the compounders of infallible hair-dyes desired to be represented in an exhibition of steam machinery, for instance, they would, though not having that reputation for modesty enjoyed by the gas companies, send in beforehand to the committee having the matter in charge and ask permission. But the gas companies have become so habituated to infringing upon the rights of others, so expert in the art which is vulgarly known as "bulldozing," that they are more apt to act first and ask permission afterward.

We rejoice, however, that electricity and gas are now exhibited side by side, for we have great confidence in the comparative success of the former as an illuminant, and believe that its greater efficiency in this regard can in no better way be demonstrated than by exhibiting its lighting powers in the presence of what once was its rival and is yet a competitor in the minds of the few who have, perhaps, had neither the time nor the inclination to compare the two.

Although electricity takes the precedence of the other subjects in the exhibition at Manchester, it forms by no means the most prominent feature in the show, owing to the keen rivalry of the gas engineers. The only electrical firms of note that are directly represented are the Swan incandescent and the Electrical Storage companies. The former have undertaken the illumination of part of the hall and a suite of rooms furnished in various styles by a local upholsterer, while the latter send a small electric light installation, consisting of a four-horse power vertical Robey engine, a dynamo machine constructed by the Brush company, a number of incandescent lights and a set of Faure-Sellon-Volckmar cells. Among the gas exhibits there are two new gas engines. These have attracted much attention, and very properly, we think, because they are even more economical than the types that have preceded them, and when these were used in driving electric dynamo machines, they generated more electric light than could be had were the fuel used directly as an illuminant.

We have never insisted, like some of our cotemporaries, that gas, either generated from coal or other minerals, would soon find no market. On the contrary, we regard gas, for certain purposes, indispensable, but illumination is not one of these.

As is well known, only a small part of the theoretical power of coal is recovered in the steam engine, while in the gas retort we have these valuable residuents, tar, coke and ammonia, the sale of which greatly reduces the cost of the gas extracted from the material of which they once formed a part. We believe, therefore, that gas will be the fuel of the future just as surely as electricity will be the illuminant.

Lighting up the Human Body.

If a report which reaches us from England may be relied upon, a use has been found for the electric light which, at least, equals in value any that have yet been discovered. The alleviation of human suffering has always been looked upon as the highest, the noblest work in which man may engage; and if, as our report indicates, a means has been found whereby the work of the surgeon may be rendered certain by electricity, the very acme of electrical perfection has been attained.

Dr. T. Oliver, of Newcastle-upon-Tyne, recently gave to the members of the Northumberland and Durham Medical Society the details of an examination made by him by aid of an electric light of the interior of the human liver. Dr. Oliver, who, it seems, is a well-known and reliable surgeon, had a patient for years a sufferer from a liver malady. The precise nature of this could not be ascertained, as the symptoms were, to a certain extent, unlike those which are significant of well-known disorders. He determined, therefore, to make an attempt to light up the unhealthy organ, which would enable him to thoroughly diagnose the case. In this, he says, he was entirely successful. An incision of the liver was made, and the interior of the cyst was lighted up by a miniature Swan incandescent light, enclosed in a silver-plated brass tube, glazed at the end and inserted into the wound. The tube was 9½ inches long and ⅛ inch internal diameter. It was smeared with carbolized oil before being used, and carbolized glycerine may in future be used instead of glass for the window of the tube. The lamp was lighted after the tube was inserted and the surgeon says that he was enabled to clearly see the internal walls of the cyst, and note the signs of disease. The incandescent lamp used was about the size of a bean, and gave a light of two or three candles. It was fed by two Bunsen cells, and kept cool by the circulation of water in narrow tubes around the hub, a head of pressure being given it by the hanging of a can or reservoir from the ceiling of the room in which the operation was performed.

Only surgeons can fully comprehend how invaluable this discovery is likely to prove in that department of the art of healing which appertains to the diagnosis, prognosis, and treatment of the class of diseases which require manual or instrumental measures for their cure. The sphere of surgery is at once more limited and more accurately defined than that of medicine, but notwithstanding the many successful internal operations that have been performed by its aid, their number is small in comparison to those which have failed by reason of the impossibility of accurately guiding the knife in darkness.

The incandescent lamp, with which it is designed to light up various parts of the human internal structure when under the knife, requires no air—indeed, air would destroy its life—gives off no impurities, can be regulated from without, and is easily handled.

If it can be made serviceable in an operation upon the liver, it can be made equally serviceable in dividing tissues and parts improperly united, and uniting those which have been divided when they should remain in union; in separating whatever has become dangerous or inconvenient to the patient; removing foreign bodies or parts of the body which from disease or loss of vitality have become foreign, whenever they exert a hurtful influence on the animal economy, and by this means may be restored to their cavity, or replaced in their normal positions, those portions of the body which have, accidentally or through rupture, become displaced; the loss of blood may be checked from wounded or divided internal blood-vessels, and the purulent or phlegmenous matter which may have been deposited by them removed.

Possibly, in the future, the surgeon may be enabled not only to remove tumors by electricity, as he can do at the present time, but from the same battery or electric accumulator draw sufficient light to illumine the internal field wherein he is at work.

At last the French have awoke to the importance of telephonic communication, and the Government is, according to recent dispatches, taking active steps to connect all the telegraph offices in Paris and the chief ones in the provinces, as well as at the principal railway stations. The charge for using these will be 25 centimes (5 cents).

The Marine Telegraph.

Before the introduction of the magnetic telegraph, the manner of signaling the arrival of vessels at Sandy Hook, N. J., and other points was by means of the semaphore system The semaphore company had stations at Sandy Hook, the Highlands, N. J., Staten Island, and in the Custom-house cupola, New York City. Some forty years ago the number of vessels arriving at this port was comparatively few, and the semaphore system was quite sufficient to do the work, even although its code was not by any means an extensive one.

For some time after the introduction of the magnetic telegraph system, the two companies worked in opposition to each other, and the semaphore method held its own tolerably well; indeed, in some respects it excelled the magnetic system, for while during hazy or foggy weather they were both at sea, so far as the signalling of vessels was concerned, in very wet weather, owing to the poor construction and insulation of the wires in those days, the magnetic was almost invariably better. But as the wires were improved, and the arrivals at this port rapidly increased, the semaphore people soon found it to their interest to consolidate with the magnetic telegraph company.

At the present day it may be said that every port in the two hemispheres is connected by a telegraphic system with all the principal cities and marts of the world; for, although there is not an international company regularly organized for the purpose, the various associated press companies and news agencies virtually do the work, undertaking, as they do, to forward information of the arrival and clearance of all vessels reported to them, thereby, in a great measure, governing the trade of the world. For instance, a woolen merchant in London, observing the clearance of a vessel with a cargo of wool from Melbourne for London, and noting its probable arrival there, in connection with his other information, regulates his sales or purchases accordingly, etc

The headquarters of the New York Marine Telegraph lines, of which Mr. Henry Holland is manager, is in the Maritime Exchange, 70 Beaver street. There is also a marine department in the operating room of the Western Union building, presided over by Mr. James McParlan, assisted by Messrs. Higgins and Callahan. These two companies have pooled their interests, and use the same wires and stations.

The marine department in the Western Union building is open at all times. It connects by wire with Sandy Hook, N. J.; Quarantine Station, N. Y.; Fire Island, 63 miles east of New York City, Highlands, N. J.; and City Island, L. I. Sound.

Each of these offices is supplied with a complete set of the international code of signal flags, and also with large day and night telescopes, by means of which vessels can be sighted at a maximum distance of 25 miles in clear weather. Each office is also furnished with a correct record of the numbers, or rather combination of letters, which is assigned to every registered vessel by the International Lloyds—which combination each vessel is expected to display as she nears a port.

A list of vessels due within the succeeding 24 hours is sent to the outside offices daily by the New York office.

Towers have been built for the offices at Sandy Hook and Highlands, the former is 67 feet high, the latter stands on a bluff and is about 300 feet above the sea. Although the Highlands station is somewhat further from the New York channel than Sandy Hook, yet, owing to its higher altitude, vessels can be discerned from it more readily than from the latter point, as each foot of elevation brings a steamer into view one minute the sooner.

Vessels from Boston, Portland, Me., Nova Scotia, etc., are reported from City Island, while those from the Southern States, South America and Europe are reported by the other stations. As every ocean line of steamers has some characteristic manner of constructing the masts, yard-arms and rigging, either as to the number of masts, their position or otherwise, and also has a particular style of painting the funnels of its steamers, the look-out operator being aware of these peculiarities, and knowing which steamer of a certain line is due, when he observes the above distinguishing features of a line at once signals the steamer's arrival to New York. Sailing vessels are distinguished by the name of the ship flying at mast-head, and also by the international code of signal flags previously mentioned. At night vessels burn prearranged colors by which they are identified.

By means of this system of signalling, the safe arrival of vessels is chronicled from three to five hours before they reach their respective dock.

As soon as a steamer is signalled, the New York office at once notifies the agents in New York and Europe. For this service from $5 to $8 is charged.

The Custom-House agents are also notified, and so also are the Post Office authorities, that in case of necessity a sufficient force may be on hand to distribute the foreign mail in time for the next out-bound trains. The general public is also notified upon application at any office of the company of the arrival of any steamer at any time of the day or night at a special charge of $1.

The arrival of as many as 300 vessels into the port of New York has been signalled in three consecutive days.

A meeting of representatives of electrical companies was held on the 20th inst. in the Borel building in response to a call from the Gramme, American, Brush, Edison, Fuller, Jablochkoff, United States, and Western electrical lighting companies. The object was to be an examination into devices for underground wires for electric purposes, with a view to a union of all the companies in a single system. Eleven telegraph companies—including the fire alarm and police telegraphs—four district messenger companies—including the burglar alarm a telephone company, and five electric lighting and power companies are employing wires in this city.

Several of these companies possess underground rights, of which a few have taken advantage. The Edison Company has a complete system in operation, extending under sixteen miles of streets. The twenty-one companies, having substantially the same requirements, could not lay independent systems because of the immense absorption of capital and the disturbance of the streets. The corporations, it was said, are as anxious as the public to have the problem solved. The ideal system is one under which every house may be supplied, on demand, with burglar alarm, messenger call, telephone incandescent electric light, arc light, time wire, stock register, lifting and pumping power, or telegraph connection, without delay, undue cost, removal of the pavement, or disturbance of the streets. Of the 350 devices already patented, none furnish a solution of the problem. Representatives from each of the twenty-one companies, and from several Eastern scientific schools were invited.

Among those present were Col. Thos. J. Montgomery of the Brush-Swan Electric Light Co., Col. R. R Hazard of the Gramme Company, G. W. Hebard of the United States, Clarence Cary of the Western Union, H. W. Pope of the Manhattan District, Major Eaton of the Edison, A. B. Chandler of the Fuller, Mr. Shaw of the Law, J. P. Davis of the Metropolitan Telephone and Telegraph, E. Holmes, W. E. Athearn, H. C. Roome, Prof. Henry Morton of the Stevens Institute, Elliot Smith, C. A. Cheever of the Jablochkoff. Mr. Bailey, S. J. Gorden, S. L. Parish, C. W. Price, Mr. Frick, and W. C. Behrens of the Gramme Company. Mr. Davis acted as Chairman, and Mr. Behrens as Secretary.

Remarks were made by Montgomery, Davis, Pope, Chandler, and Shaw, and resolutions were adopted declaring that the time has arrived for making an exhaustive examination of all devices for underground electrical communication.

Electrical Notes.

The plan to establish a school of electrical engineering in Columbia College will commend itself to those who think that a metropolitan university should, at least, keep abreast of the times.

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Great things are to be expected in the future from electricity. The limit of its application is not even in sight, and the wonders that have already been accomplished through its agency give us reason to entertain the belief that this generation shall pass away and the end of electrical development not yet attained.

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The School of Mines of Columbia College is an admirable institution. It has often been favorably compared in thoroughness with the famous *L'Ecole des Mines* in Paris. Yet, during the past few years when the application of electricity was receiving such thorough and important development, the School of Mines was graduating young men in a scientific course in which electricity played a small and unimportant part.

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These young men, like their fathers before them—perhaps their grandfathers—have been taught that electricity is a branch of natural philosophy which investigate the attractions and repulsions, the production of light and the elevation of temperature as well as the explosions and other phenomena attending the friction of vitreous, resinous and metallic surfaces, and the heating, cooling, evaporation and mutual contact of a great number of bodies; that its name is derived from the Greek word ηλεκτρον (amber) in which substance its phenomena were first observed, and lastly that the ancients, like the graduates from the School of Mines, knew little about it.

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During their course at college the prescribed and somewhat aged electrical tricks are shown them A dry glass rod, a piece of amber or sealing wax is rubbed briskly with a dry woolen cloth, and is then presented to a dry body, such as a fragment of paper, a thread, a cork, a piece of straw or cotton or gold leaf, and the attractive and repellant powers of those various substances is demonstrated.

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Then comes the metallic ball experiment. The ball is suspended in the air by silk, thread or fibers of worsted or hair, and rubbed while in this situation by an electric substance, when it exhibits the same properties of attraction and repulsion as an electric.

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They are now told that the permanence of electricity in metallic bodies suspended in the air by silken thread, proves that the air, as well as silk, is a non-conductor; from which circumstance, bodies surrounded by it except on one side, and this side being in contact with a non-conductor, are said to be insulated. That if this condition be not observed—that is, if a body be in contact with conducting substances which communicate with the earth—its electricity will escape through them to the earth, which may be regarded as the great reservoir, both for the absorption and supply of this fluid.

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Next comes the white and black ribbon trick. This consists of placing pieces of black and white ribbon together, and then drawing them quickly together between the finger and thumb. They are then found to adhere together, and if pulled asunder at one end, will rush together with great quickness, though when united they exhibit no sign of electricity, because the operation of the one is just the reverse of that of the other, and the power is, of course, neutralized and inoperative.

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After this comes a long and tiresome series of other experiments of the same kind, supplemented with attempted illustrations, by means of aged and infirm electric machines, which never seem to be able to accomplish that which has been promised for them.

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All this sort of thing serves only to give the student a few disconnected ideas concerning electricity, and he leaves college under the hallucination that electricity is but another of those curious and incomprehensible subjects which have been furnished to the professor to enable him, at least, to perplex the understanding of the undergraduate, if he cannot be bored to death.

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Now, take one of these same college boys on a visit to the manufactory of an electric lighting company to that of a telephone company; show him an electric motor or a tricycle in course of construction, and explain to him the recent discoveries in the electrical field, and just how the power is applied, and it is ten to one he will be greatly interested from beginning to end.

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"What!" he demands in surprise, "do you mean to say that this is electricity?" "Why, I thought electricity meant rubbing amber on cloth, trying to get sparks out of a broken-down friction machine, and dozing before a professor talking about electrical theories, attraction and repulsion, laws of induction, and the like."

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We do not wish to imply that we think a grounding in physical laws and electrical theories unnecessary to the student; on the contrary, they would furnish him with a valuable capital upon which to enter into the more practical work. But it is hard to interest him in these things before he is made to understand where they lead to, and it is far easier for him to work these out for himself when their practical application has been demonstrated in the workshop.

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If you can interest a pupil in a given subject, your work is as good as accomplished, for you have placed him in a position where he can help himself.

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At the recent meeting of the Board of Trustees of Columbia College, it was decided to establish a practical school of electrical engineering, as an adjunct to the school of mines. This school is to be fitted with working models of all the recent electrical inventions.

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A well-known practical electrician was asked by the trustees to estimate the cost of the necessary plant, and he replied that $15,000 would cover the first cost, and after that the school could be kept up for $25,000 a year.

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As we all know, the telephone and electric light companies have great difficulty in procuring efficient employés, and the proper conduct of such a school would result in turning out young men well fitted to assist in practical work.

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This being the case, it is proposed to ask the different telegraph and telephone companies to supply the plant and contribute $12,000 a year to the support of the school. In case this request is granted by the companies, the school will at once be established, the present professors taking a share of the work, and new and practical professors being engaged so far as necessary.

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"There was a great panic last Friday at the Grand Opera House of Milwaukee, at New York, during the representation of 'Lights o' London.' At the third act the electric light machine, which was placed upon the stage, exploded with great force, causing terror in the *saloon*, which contained 600 persons," &c.

Electricity must be very tenacious to life to resist such attacks.

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We would respectfully request the editor of the London *Electrical Review* to take down

his atlas if he has one—it would be charitable to believe that he has none—and look up Milwaukee, and then New York. Again, as to facts, there is no Grand Opera House of Milwaukee at New York, there was no explosion of an electric-light machine in the Grand Opera House in New York, and if there was any terror in the *salle* during the representation of "Lights o' London" it was not caused by the explosion of an electric-light machine, but may have come possibly from an audience wrought up to an excited state of disgust at the spectacle presented by cockney actors representing scenes from cockney-dom and cad-dom. The fact was that a Wallace dynamo exploded in Columbia College.

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The annual public meeting of the Académie des Sciences was held April 2d, under the presidency of M. J. Jamin. A portion of his opening speech, relating to the progress of electricity, is worth reproducing: "For the first time, electricity, considered formerly as a simple curiosity, has become a public necessity, and will rank among the most valuable adjuncts of civilization. A single wire suspended in the air, or traversing the seas, is sufficient to transport to a distance, with the speed of light, illumination, magnetization, heat, motion, writing, speech, all physics and all chemistry. Electricity has become the general and instantaneous agent of every transmission. It is, in a word, energy itself, liberated at a point of origin, conducted where we wish, and doing there any work which we require. It is this power of electricity which has been justly called a miracle." The speaker also remarked, very appropriately, that electricity has been the fortunate rival of politics, and that it has accomplished another miracle by succeeding in producing between the *savants* of two neighboring nations, who had not yet disarmed, a commencement of reconciliation. The remainder of the presidential address was devoted to the passage of Venus, to the works of M. Pasteur, and to an eulogy of M. J. B. Dumas. They then proceeded to the distribution of rewards.

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In a communication to the Seismological Society of Japan, Prof. Paul gives some interesting notes on the effect of railway trains in transmitting vibrations through the ground. A box holding about twenty pounds of mercury, thickened by amalgamation with tin, was placed upon a heavy plank screwed to the top of a post sunk four and one-half feet into the ground. This simple arrangement being made, images reflected in the surface of the mercury were observed by a telescope, as in meridian observations; and an express train, passing at a distance of one third of a mile, set the surface of the mercury in confused vibration for the space of two or three minutes. Other observations were made at stations at somewhat greater distances with equally interesting results. The experiments also showed, among other phenomena in this line, that a one horse vehicle passing on a gravelled road 400 or 500 feet distant, caused a temporary agitation of the mercury whenever a small stone was struck by the wheels. Other instances of similar sensitiveness were also noted.

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M. D'Arsonval, the well-known telephonist, has devised a new form of Bell receiver, which is, for its size and weight, the most powerful yet constructed. The chief modification consists in enclosing the bobbin entirely between the poles of the magnet. This is done by making one pole of the magnet the core of the bobbin, and the other pole an enclosing ring of iron. The inductive plate vibrates over the poles and upper surface of the coil as before. The complete instrument only weighs a little over five ounces and is stated to be as powerful as the heavy Gower-Bell receiver. M. Leczensky has applied magnets of steel tempered by compression after the manner introduced by M. Cleman dot, and since this mode of tempering does not deform the magnets, a neater article is the result.—*Engineering.*

Mr. C. Langdon-Davies in writing to the London *Standard* says of the Van Rysselberghe system of electrical communication, "Anything which any telephone can do, and also anything which any telegraphic instrument can do, are, by means of this system, made practicable simultaneously. That is to say, if the system were applied to the telegraphic wires of this country, the whole network would become available for the transmission of telephonic messages, conveying the full force of the voice to long or short distances, without interfering with or receiving interference from the telegraphy, which would be continued precisely as before, on the same wires at the same time." Perhaps if this system were tesfed by the English postal authorities Mr. Langdon-Davies might have cause to modify his statements to a considerable extent. At present such public communications on the subject of telephony and telegraphy must be taken *cum grano salis.*

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The Bernstein Electric Light Company have recently put their light into the Boston post-office. It has been pronounced a success by all who have examined the features of this new incandescent light.

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A Montreal firm has invented and patented, it is said, a machine for cooking by electricity. It consists of a saucepan so isolated by non-conductors that the bottom forms the positive pole of the current. The negative pole is attached to a movable point which travels in circles over the bottom of the pan underneath, distributing the heat over the whole surface and with sufficient rapidity to avoid burning a hole through the pan at any one point

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The General Term of the Superior Court affirmed the injunction granted by Judge Arnoux in the suit of W. S. Williams to restrain the payment of dividends on $15,000,000 of new stock issued by the Western Union Telegraph Company to its stockholders when it was consolidated with the American Union and the Atlantic and Pacific. Chief-Justice Sedgwick concurs with Judge O'Gorman, who writes the decision. Judge O'Gorman says that the injunction order was the logical consequence of the General Term's decision that the issue of $15,000,000 of new stock to existing stockholders of the Western Union Company was illegal. The fact that these unlawfully issued shares may have reached *bona fide* holders is not to be regarded as affecting the question. If their rights are invaded, they must seek such legal remedy as on the facts of each case they may be found to be entitled to.

A similar decision was given in Rufus Hatch's case.

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A meeting of the stockholders of the Mutual Union Telegraph Company was held on the 18th instant, at the office of the company, No. 135 Broadway, for the purpose of ratifying the lease of the lines of that company to the Western Union Telegraph Company. There were represented by the owners in person or by proxy 93,340 shares of stock, and the vote in favor of ratification was unanimous.

The Brush Company's Works.

The works of the Cleveland Electric Company, including their new addition, which is now almost completed, cover six acres of ground. A draft stack which the company has recently put up is capable of making a draft for engines and boilers aggregating 1,500 horse-power. Some time during the present month the company will begin to place the new Brush storage or secondary battery on the market.

The Bell Telephone Company in its annual report does not show any great surplus for this year, but no man can set down definitely the present earnings upon Bell Telephone stock, by reason of the unknown quantity of its income upon investments in local companies. Earnings of 25 per cent. upon Bell Telephone in 1883 is a moderate estimate. No one can estimate the future value of such a patent. It is the most valuable franchise ever secured to any corporation, and if not interfered with by the courts or the legislatures may pay an income, in time, upon a capitalization of one hundred millions.—*Boston Transcript.*

When some time ago we wrote that the telephone interests of this country would surpass in value the telegraph interests, we were not aware how quickly this would be the case. Despite the fact that the Western Union Telegraph Company has a share capital of $80,000,000, double the capital of the same company some time after the telephone was invented, this $80,000,000 of capital, at its market price of 84, does not equal in value the market price of the Bell Telephone capital, combined with the market value of the sub-companies working under its patents. That the commercial value of telephone, five years after its introduction to the public service, should be greater than the value of the telegraphic system of this country after twenty-five years of operation, no one would have dared to predict until very recently.—*Ex.*

Editor London Electrician:

SIR: As your editorial note of p. 374 invites me to give the references that I have indicated in evidence of Reis's claim to be the inventor of the telephone, which he designed for the express object of transmitting human speech and other sounds of all kinds, I have much pleasure in giving you the very same references which I have myself obtained from the published writings of Graham Bell ("Researches in Telephony," *Journal of Society Telegraph Engineers*, 1877), and of Edison (see "Prescott's Speaking Telephone,' p. 218).

The following are a few of Bell's references:

(1) "Telephonie," *Dingler's Polytechnisches Journal*, CLXVIII., p. 185, extracted from the *Jahre bericht des Physikalischen Vereins zu Frankfurt am Main*, 1860-61, p. 57-64.

This is a scientific memoir by Philipp Reis, having for title "On Telephony by the Galvanic Current." On p. 58 he says his endeavor was to find an instrument which should reproduce the total action of all the organs set in action in human *speech* (menschlichen Sprache), and that he took the human ear as model, because the tympanum of the ear could respond to all sounds. After discussing the problem of representing the pressures of the air in sound waves by a "curve," he says that if it is possible at any place to reproduce vibrations having a similar "curve," the very tones will be reproduced. He then says that, taking his stand on the principles laid down, he has succeeded in reproducing the tones of various instruments, and to a certain degree the human *voice* (die menschliche Stimme). After describing his instrument—the well-known combination of a tympanum in imitation of that of the human ear, with an electric current regulator, consisting of an interrupting apparatus, which embodied the loose-contact principle of the microphone, and which is in many respects exactly like the interrupter in the Blake transmitter—he says (p. 62): "I give to my instrument the name 'Telephon.'" Later on he says that the reproduction of human speech which he has attained is not so clear as to satisfy everybody, and that though the consonants are transmitted distinctly enough, the vowels are not equally so, and he proceeds to discuss why this is the case.

(2) *Brix's Zeitschrift des deutsch-oesterreichischen Telegraphen Vereins*, 1862, Vol. IX., p. 125. This article is also reprinted in *Dingler's Polytechnisches Journal*, 1863, Bd. CLXIX., p. 23.

This is a report by Inspector von Legat on Reis's telephone in its developed form. Inspector von Legat says that this instrument was able to reproduce single words uttered as in reading and speaking, though not so distinctly as it reproduced chords and melodies, which latter it transmitted with marvelous fidelity. He even added that the inflections of the voice, the modulations of interrogation, exclamation, wonder and command attained distinct expression.

So much for Bell's references. Edison's reference is the same as No. 2 of the preceding.

As to the publicity of these documents, permit me to refer you to the shelves of the British Museum and other public libraries.

I do not say that there is not plenty of further evidence, were such needed. But here I am quite content to accept the references given by such unimpeachable authorities as Bell and Edison. When they refer me to papers wherein Reis says, in substance: "I am the inventor of the telephone. My instrument is intended to transmit human speech and all other kinds of sounds that a human ear can hear, and it succeeds in doing so, though I find to my disappointment that it is not yet quite perfect, because, though single words and consonants come through all right, the vowels are not clear"—I am bound to believe, on the authority of Bell and Edison, who give me these references, that Reis's modest claim is just. And I am bound to this belief still more strongly because I find, when I make careful trial of Reis's own telephones, that they will do exactly what he said they were intended to do, namely, transmit human speech to a distance by the agency of the galvanic current.

You have, Mr. Editor, most aptly said that the question is, What was *the kind of success aimed at* and attained by Philipp Reis? and I entirely agree with you that this question is not in the least degree affected by whether Philipp Reis is dead or alive. Though himself be dead, and the task of defending his memory from outrage falls to others, his words still live to testify in the most unmistakable manner to the aim which he set before himself, and to the measure of success which he attained in his invention of the telephone.

Yours, &c.,

SILVANUS P. THOMPSON.

Bristol, March 4, 1883.

P. S.—There is a slight *erratum* in line 12, from bottom of p. 373, where, by mischance, the word which I wrote has been altered from *perfected* to *perfect*. Philipp Reis's telephones of 1862 were not perfect, but were perfected instruments, compared with those he showed to the Physical Society in 1861.

The Cost of Power.

It is only a few weeks since that we found in one of our English exchanges an item relating to the above subject, and which, since its first appearance in an American contemporary, was extensively copied. Though having experienced some change in going the rounds of the press, the item has retained its main and distinctive features, and the estimate given of the cost per hour per horse power of various motors is about as follows:

	Cents.
100-horse power steam engine	1.9
2-horse power steam engine	11.07
2-horse power Lehman caloric engine	6.62
2-horse power Hock motor	2.00
2-horse power Otto gas engine	6.52
2-horse power Otto-Langen gas engine	6 52
2-horse power Schmidt water engine (fed by city water supply)	23.75
Horses	11.10
Men	50.00

The experiments yielding these results were said to have been made at Carlsruhe, Germany, and their adoption in a number of papers as standards of comparison, and as having any value whatever, has given rise to severe criticism. The *American Engineer*, in considering the question some time ago, said:

"The absurdity of judging of the economy and of instituting comparisons of prime-movers on the basis of such slender and erroneous premises, and the fallacy of the above item, in the general sense in which it is put forward, is best characterized by the last line—'Men, 50 cents.' We dare say, in Carlsruhe, as the world over, some men get 50 cents an hour for their labor, some 25 cents, and some, when subject to the will of corporations, but 17 cents an hour. So, too,

the 100-horse power developed by the steam engine may cost 1.90 cents per horse power per hour, 2.20 cents per horse power an hour, or 1.70 cents per horse power an hour. If fuel and wages are sufficiently high—as say, in some of our Western States—the 100-horse power developed by the steam engine may rise in cost to 3 cents per horse power and above. The variations of the 2-horse power steam engine are apt to be much greater, and according as it requires more or less attendance, or forms the only cause for expense of skilled attendance, or is only part of a large system of steam plant, the price per horse power per hour of the 2-horse power engine will vary immensely. So, too, with all the other motors enumerated, including the horses, whose size and weight and fuel or oats capacity, as well as the price of oats, will affect the current expense. It is possible that the statement, as presented in its original German form, where possibly all the qualifying elements were stated, was correct, though we are even inclined to doubt this. For any one who attempts to summarize results as this table shows them is given to a form of generalization which is usually productive of erroneous and foolish results. Leaving, however, the original German account out of the question, it is absurd to reproduce the statement as it appears above, in any scientific or technical journal. It only goes to show how anxious people are to know results without going to the trouble to obtain them themselves or to discover if they are correct. That an item of the above kind finds reproduction in the technical press, as this one has, is a sad evidence of the state of journalists' opinion as to what class of engineering information is desirable. The comparitive economy of different prime-movers is a matter which can be judged of in specific cases and for specific purposes, adding together the tems of expense for each prime mover. Such items vary slightly at every different place, and usually vary considerably in localities some distance apart. The comparison is affected by the cost of the materials of construction, the cost of labor, the price of fuel, salaries of engineers, the cost of oil, the interest value of money, and many other conditions which materially influence the expense of each separate prime-mover. Having given all the items of expense, it is usually no difficult matter for an engineer to settle the most economical conditions of running and the prime-mover most economical in any particular case, but to this trouble he must go, and will undoubtedly do so cheerfully. It is the general public who are influenced (and, alas! perhaps sometimes guided) in their ideas and practice by statements of the type we criticise; but the engineer smiles at them and lets them pass as useless trash."

To the Editor of the Electrical Review:

I notice in your last issue a communication signed "Gorham Gray," in which my article upon the claims of the Spiral Wire Company is criticised in a somewhat vituperative manner.

I pardon the vituperation, however, upon the ground that out of the abundance of the heart the mouth speaketh.

I regret that I have neither time nor inclination to notice or reply to the several items of Mr. Gorham Gray's communication, in which he disagrees with me; being content with the fact that I have once stated the truth in the interest of the telephone men of the United States.

I may, however, congratulate myself upon the fact that Mr. Gorham Gray makes one statement which I can heartily indorse, and with which I am completely in accord. That is, that his results "are not understood by electricians." If by results he means his theory, I can most certainly agree with him. They are not.

But though not understood by electricians, we find that they are understood by Mr. Gorham Gray.

The inference is obvious: Mr. Gorham stands self-confessed, he is not an electrician.

How can he expect his explanation to be credulously received and implicitly believed in by those who *are* electricians, and who have made electricity the study of a lifetime?

THOS. D. LOCKWOOD.

Electricity in Engine-Houses.

GEN. DIAZ WITNESSING THE WORKINGS OF THE EDISON SYSTEM.

Ex-President Diaz, with his wife and the members of his suite, were initiated on the 16th inst., to a limited extent into the mysteries of Edison's system of electric lighting. The party was conducted on its tour of observation by Thomas A. Edison and his wife, Mr. N. F. Hastings, Secretary of the company, and Col. Sherman, who represents the company in South America. The first place visited was the house of engine No. 32, in John street, which is fitted with the Edison light. The house is one of the model engine houses of the city, and the record of its company is shown by a handsome library presented to the members by Goodwin & Company, for bravery shown in entering a building stored with powder and other explosives, at No. 206 Front street, July 12, 1880, and extinguishing a fire. There are the usual automatic appliances, and in addition Mr. Edison has contrived an arrangement working in unison with them by which the electric lights are turned on the instant the alarm bell rings. When the visitors arrived Captain Joseph F. McGill had the lights extingushed and his men were sent to the bunk-room on the second story. The quiet that pervaded the house was broken by the sounding of the alarm. Lghts were turned up, firemen came from their bunks on the sliding poles, and in four seconds, according to time taken by Gen. Diaz and his party, the horses were harnessed, the men in their seats, and everything ready for the trip to a fire. The experiment was repeated a half-dozen times, and each time was greeted with applause, in which Mrs. Diaz led. General Diaz led in the cheering which greeted the performances, and expressed himself as very much gratified, saying the performance surpassed those he had witnessed in Boston.

After leaving the engine house the party visited the First District works, in Pearl street, and then the machine shops in Goerck street, and Mr. Edison's laboratory, at Seventeenth street and Avenue B. Elaborate explanations were made by Col. Sherman, who is an old friend of Gen. Diaz, and were listened to with much apparent interest by the members of the party.

The Shortcomings of the Telephone.

Herr Bretzell (who has just had a telephone put up, calls for the repairer next day)—Look-a-here, my vrent, tidn't you dole me dot dellervone shbeak Cherman unt converse in Cherman?

Repairer—Yes, sir.

Herr B.—Vell, py chiminetty, I dalk Cherman to dot dellervone yesdertay, mid bolideness, unt py unt py it say, "Hello! Phawt the divil air ye jabberin? Come off ye ould Dutchy." I tond't allow no dellervone to sass me dot vay. Donnerhimmel! Dake it avay!—*Life.*

The ELECTRICAL REVIEW has made its bow to the public. It is a neat illustrated weekly, devoted to the interests of the electric light, telephone, telegraph, and scientific progress. Delano & Co. are the publishers.—*Sewing Machine Journal.*

We have just received among our changes the *Electrical Review*, a weekly paper published by our old friend and former publisher of the *American Art Journal*, Thos. J. Delano.

The *Electrical Review* is a very interesting and instructive 16-page paper, and judging from its advertising patronage is an assured success. We are satisfied that not only we ourselves, but every one in the music trade will be pleased to hear of his good fortune.—*The Free Press.*

An exchange locates the following in Richmond, Va.:

Judge—Martha, light the gas.

Martha—It is lit, sir.

Judge—Well, then bring me a candle. My gas-bill has just come in, and I want to see how much it is.

Manufacturing News.

New Machine Shops, Foundries, Hotels and Mills.

The frame for the mammoth skating rink at Old Orchard, furnished by the Kennebec Framing Co., of Fairfield, is in readiness to be erected as soon as the ground becomes settled. The building will be 175x80 feet, one story, with sufficient height inside to admit of a gallery all around.

We notice that the office of the *Commercial Advertiser* is now brilliantly lighted by the Edison Incandescent Light, the United States (Maxim) having been removed, as we are informed it did not give satisfaction.

The Duggan-Parker Hardware Manufacturing Company, of St. Louis, Mo., propose to make room for an additional foundry for making brass castings.

The E. T. Barnum Wire and Iron Works, of Detroit, Mich., will occupy their new factory by May 1. The building is 400x103 feet, and four stories high.

The Standard Foundry Company, of St. Louis, Mo., will increase the capital stock to $25,000. The capacity of the works will be increased about 50 per cent.

A company has been formed in Louisville, Ky., with $1,000,000 capital stock, to manufacture automatic train signals invented and patented by W. W. LeGrande.

Smith, Hill & Co., of Quincy, Ill., manufacturers of milling machinery, have recently purchased a new building, to which they will remove their machine shops some time in July.

Work has been begun upon the foundations for the mill of the Kelly Iron and Nail Company, at Ironton, O.

The ordnance department of the army has addressed circulars to the leading American open hearth steel making establishments asking if the steel required for the new steel guns can be furnished.

The new factory of the Western Electric Company at Chicago will be 50x250 feet in dimensions, with wing 110x58, four stories in height, and will represent an expenditure of $100,000.

New York is to have a new aqueduct to increase the water supply, costing some $25,000,000. If done in the usual New York style it will cost $100,000,000.

The capacity of pipes is as the square of their diameter. If you double the diameter of a pipe, you increase its capacity four times.

The leather board mills at Leominster, Mass., destroyed by fire April 1 (see Fire Record), will be rebuilt at once, operations beginning at the earliest possible moment.

The focusing lights and reflectors of the Fuller Electrical Company are serving a very useful purpose, and becoming popular, in connection with steamboat service, and for the illumination of wharves and docks, on the great lakes and rivers of the West.

The telephone companies under Lowell management increased their subscribers in March as follows:

	Gain.	Total, April 1.
National Bell of Maine	88	3,827
Boston and Northern	95	3,034
Bay State	119	2,525
Suburban	100	1,200
Union	25	285
Granite State	5	419
Northwestern (official count—does not include complete list)	13	1,268
Totals	445	12,558

The Lowell telephone stocks, so-called, are attracting considerable attention in the Boston market just at present. Their popularity is certainly well deserved, for as far as activity and money-making are concerned, they have surpassed anything seen here in the dull and bearish markets which we have experienced for so long a time past. Judging from its past experience, this class of securities has a long and successful future before it.—*Boston Post.*

Secretary Chandler has instructed the naval advisory board to prepare plans for five new United States war vessels, consisting of three steel cruisers and two torpedo boats, and to arrange for the completion of the four unfinished monitors. One of the cruisers is to be 4,300 tons.

The Pennsylvania Electric Light Company have, after examination of the different electric-lighting systems, adopted that of the Fuller Electrical Company, and an installation of one hundred lights has lately been shipped to the capital of the Keystone State, as the first step in its business career.

Business Notices.

The attention of persons interested in local telegraph and telephone organizations is respectfully called to the electric lighting system of The Fuller Electrical Company, and the practicability of making arrangements with that company for the introduction of its apparatus, either in isolated plants, or through the formation of local companies desiring to engage in the business of electric lighting. The specially valuable feature of this company's system may be seen by examination of its apparatus in Boston, Worcester, Providence, Hartford, New York City, Brooklyn, Jersey City, Paterson, Philadelphia, Lancaster, Scranton, Syracuse, Rochester, Buffalo, Pittsburgh, Wheeling, Steubenville, Xenia, Dayton, Grand Rapids, Chicago, Springfield, Belleville, St. Louis, St. Paul, and many other smaller places throughout the country. Correspondence is invited.

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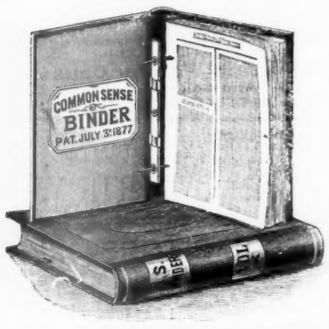

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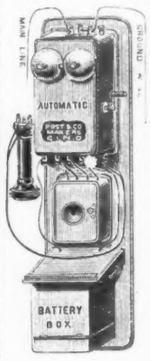

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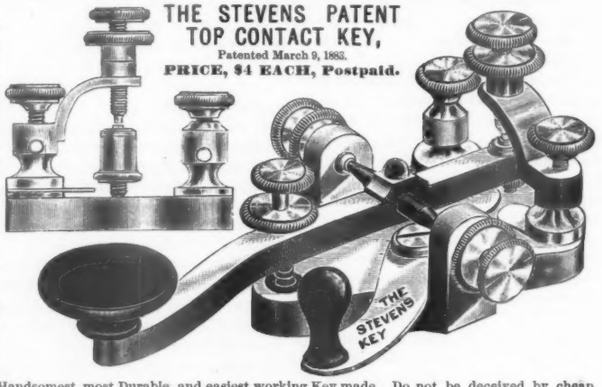

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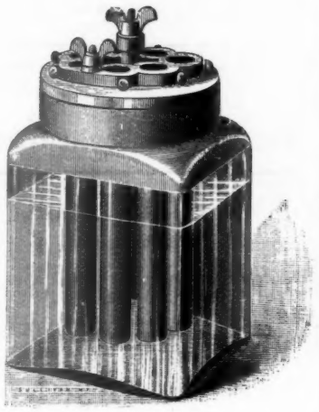

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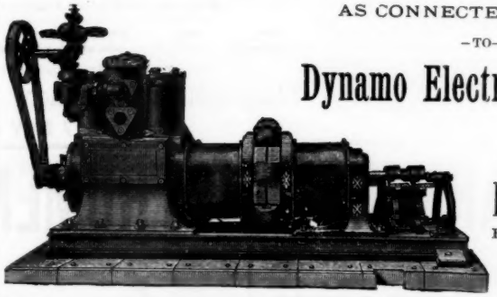

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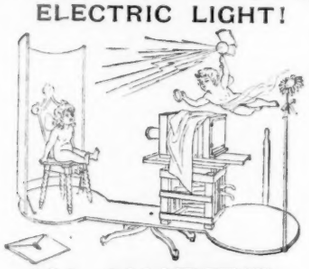

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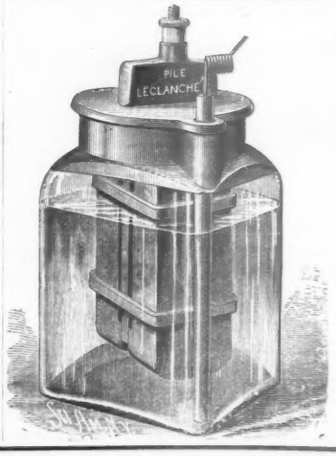

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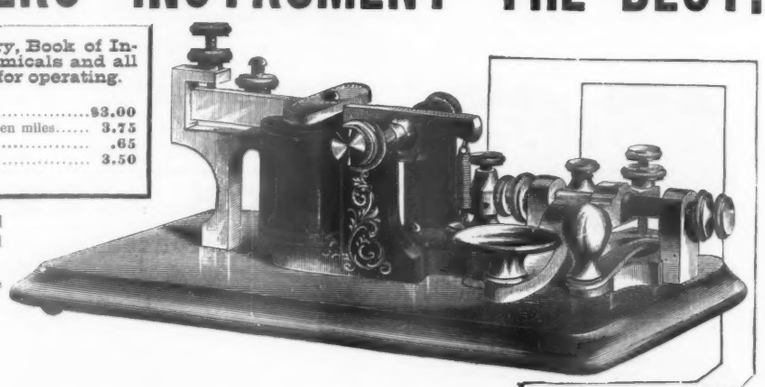

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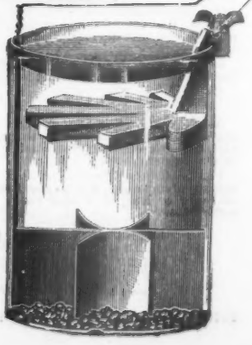

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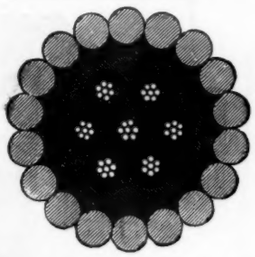

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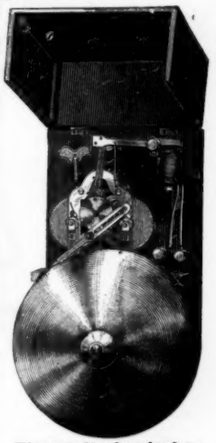

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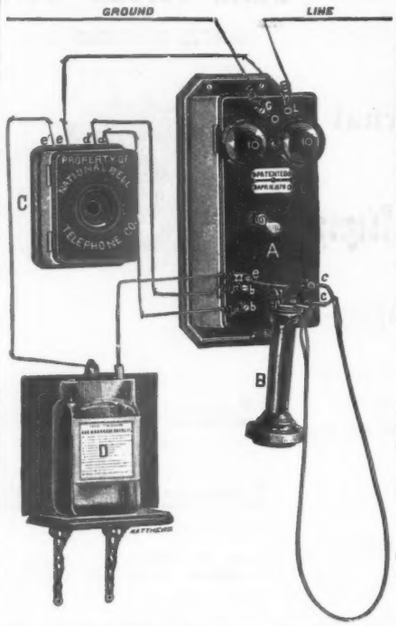

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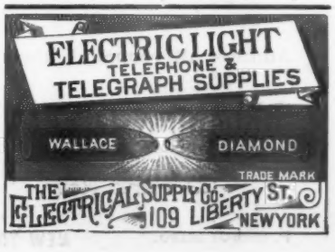
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